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INDEX.

A.

- Abortion and temporary sterility, absence of correlation between, 346.
Abortion, contagious, in dairy cattle, 377.
Adamson, N. J.—
The orchard, 52, 130, 204, 274, 349, 413.
The fireblight menace: Severe experience in a Hawke's Bay orchard, 109.
Agricultural shows, season 1928–29, 67, 148, 220.
Allan H. H.—
Review of "The Trees of New Zealand," 66.
Review of "The Vegetation of New Zealand," 213.
The economic significance of economic botany, 399.
Alkali patches, a chemical study of the so-called, 250.
Animal manures, importation of, from Australia, 19.
Answers to inquiries, 68, 146, 218, 292, 305, 437.
Apiary, the (monthly notes), 56, 136, 209, 280, 356, 418.
Apples, latest export examination dates for, 72.
Apples, maturity of, in relation to long storage, 172.
Arthritis in lambs, 288.
Ashburton Experimental Farm: Notes on operations, season 1928–29, 333.
Askew, H. O., and Rigg, T.—Mineral contents of some typical pastures in Waimea County, 304.
Aston, B. C.—
Mineral hunger in sheep: Successful treatment by pellet-feeding method, 10.
High protein content of pasture, 97.
Cure of iron starvation (bush sickness) in stock, 232.
A survey of pumice soils: The sub-soils of Rotorua County, 295, 382.
Lucerne a lime-rich plant, 397.

Atkinson, Esmond—Weeds and their identification—

Three common docks (*Rumex* spp.), 122.

Apple of Peru (*Nicandra physaloides*), 266.

B.

- Barnett, M. A. F.—The utilization of whey, 36.
Basic slag for South Canterbury grasslands, 69.
Bill Moose linseed, 220.
Biological control of pear-midge (*Perissa pyri*) in New Zealand, 317.
Birds, small, poisoning of, with strychnined wheat, 303.
Blackberry control by goats: Striking success on a Hawke's Bay station, 16.
Blindness in sheep, 437.
Blood agglutination test for contagious abortion, 380.
Blood scours in calves due to coccidiosis: Local occurrence determined, 189.
Blow-fly pest, the sheep, 115.
Books received, 148.
Botany, systematic, the economic significance of, 390.
Brassica diseases, 7.
Breeding-ewes, flushing the, 130.
Brown, F. C.—
Poultry-keeping, 54, 134, 206, 277, 352, 416.
Wallaceville Poultry Station, 238.
Bush-lands, second-class, dairy-farming on, 98.
Bush sickness, cure of, in stock, 232.
Butter, salt content of, 376.

C.

- Calves, blood scours in, due to coccidiosis, 189.
Calves, dairy, the care of, 345.
Calves, feeding of, 393.
Campbell, J. A.—Control of fireblight in the orchard, 35.

- Canterbury conditions, intensive grazing for, 177.
 Canterbury, farming problems in, 92.
 Cappings, honeycomb, treatment of, 321.
 Caseous lymph-adenitis: Precautions for sheep-farmers, 48.
 Castration of pigs, 200.
 Catarrh, nasal, in dairy cattle, 146.
 Census and Statistics Office—
 Statistics of pasture top-dressing on farms, 1927-28, 65.
 Statistics of farm machinery and engines, 121.
 Occupation and utilization of land, 190.
 Area in orchards, market gardens, and nurseries, 219.
 Statistics of irrigated lands, 219.
 Classification of cattle in New Zealand, 1928, 289.
 Cereal diseases, 3.
 Certificate-of-record and Official Herd Testing, 102, 331.
 Certificate-of-record lists, 62, 141, 285.
 Certificate-of-record system of testing purebred dairy cows, annual review for 1928, 154.
 Certification of grass and clover seed, 181.
 Certification of seed-potatoes: Provisional certificates issued, 1928-29, 363.
 Certification of seed-potatoes. Review of operations, season 1928-29, 307.
 Certified seed-wheat, sale of, 293.
 Cheese, rimless, 116.
 Cheese, mottling in coloured, 259.
 Chicory and prairie-grass, 218.
 Chinese gooseberry, 283.
 Citrus-culture (monthly notes), 54, 133, 205, 276, 351, 415.
 Cleanliness of the cream-separator: Demonstrated as essential to keeping-quality of cream and separated milk, 182.
 Climate of New Zealand, 40.
 Cockayne, A. H.—Farming problems in Canterbury: Current research work of the Fields Division, 92.
 Collins, A. D.—Salty soils in Central Otago, 250.
 Corrections, 67.
 Contagious abortion in dairy cattle, 377.
 Control of fireblight in the orchard, 35.
 Control of ragwort with sheep, 169.
 Co-operation in cream collection, 268.
 "Co-operative Dairy Company," definition of, 198.
 Cream collection, co-operation in, 268.
 Cream-separator, cleanliness of the, 182.
 Cunningham, G. H.—The New Zealand Plant Research Station: Current mycological investigations, 1.
 Cure of iron starvation (bush sickness) in stock: Practical consideration and farmer's experience with iron remedies, 232.
- D.
- Dairy calves, the care of, 345.
 Dairy cattle, purebred, export of, 188.
 Dairy-cow diseases in New Zealand: Recent research work by Department of Agriculture, 75.
 Dairy Division—
 Testing of purebred dairy cows (C.O.R. lists), 62, 141, 285.
 Electric water-heater for dairy farm, 199.
 Co-operation in cream collection, 269.
 Salt content of butter, 376.
 Dairy factories, flooring materials for, 407.
 Dairy-farming on second-class bushlands: North Auckland settlers' effective work in pasture maintenance, 98.
 Dairy-produce grading system, appreciation of the New Zealand, 284.
 Dairy research, 322.
 Davey, M.—
 Maturity of apples in relation to long storage, 172.
 Definition of "Co-operative Dairy Company," 198.
 Diseases of dairy cows in New Zealand, 75.
 Distemper in dogs: Recent research work on immunization, 24.
 Docks, three common, 122.
 Dogs, distemper in, 24.
- E.
- Earp, E. A.—
 The apiary, 56, 136, 280, 356, 418.
 Treatment of honeycomb cappings: An electric oven melter, 32.
 Economic significance of systematic botany, 399.
 Electric device for milk-tester, 114.
 Electric water-heater for dairy-farms, 199.
 Entrician, A. R.—Firewood on the farm, 191.
 Erroneous statement, an, 147.
 Estimated yields of wheat, oats, and barley, 148.
 Ewes, mating of, 292.
 Experimental work on export fruit, 300.
 Export of purebred dairy cattle, 188.

F.

- Farmers' pasture competitions: North Taranaki results, 1928, 117.
 Farming problems in Canterbury: Current research work of the Fields Division, 92.
 Farm machinery and engines, statistics of, 121.
 Farm, the (monthly notes), 50, 128, 201, 272, 347, 411.
 Fawcett, E. J., and Paton, W. N.—Live-stock production in New Zealand, 1901-02 to 1926-27, 423.
 Fertilizers Act and regulations: Registration and other provisions, 254.
 Fertilizers, importation of, in 1928-29, 404.
 Fertilizer importations (quarterly), 218, 366.
 Fertilizers, registration of, 254.
 Fertilizer samples from farmers, 346.
 Fields Division—
 Wheat-manuring experiments in Canterbury, 221.
 Certification of seed potatoes: Provisional certificates issued for season 1928-29, 363.
 Fireblight in the orchard, control of, 35.
 Fireblight menace, the: Severe experience in a Hawke's Bay orchard, 109.
 Firewood on the farm, 191.
 Flooring materials for dairy factories, 407.
 Flora and Silva, the new, 436.
 Foot-and-mouth disease in Britain, 435.
 Forbes, Hon. G. W., M.P., Minister of Agriculture in the Ward Ministry (photograph), 34.
 Foy, N. R.—The Official Seed-testing Station: Record of operations for 1928, 323.
 Fruit export, experimental work on, 300.

G.

- Galloway Irrigation Farm, progress of the, 150.
 Gill, D. A.—
 Distemper in dogs: Recent research work on immunization, 24.
 The lamb mortality investigation, season 1928, 390.
 Goats, blackberry control by, on a Hawke's Bay station, 16.
 Gorse, salt spray for killing, 147.
 Government certification of seed-potatoes: Provisional certificates issued for season 1928-29, 363.
 Grading of butter and cheese (photographs), 396, 410.
 Grass and clover seed, certification of, 181.
 Grass-yield, lawn-mower method for manuring, 168.

- Grazing, intensive, for Canterbury conditions, 177.
 Grazing, winter, of young pasture, 438.
 Guthrie-Smith, H.—Blackberry control by goats, 16.

H.

- Hadfield, J. W.—Certification of seed-potatoes in season 1928-29, 367.
Hæmatopinus pedalis, 271.
 Hamblyn, C. J.—
 Northern Wairoa Experimental and Demonstration Farm, 1927-28, 30.
 Dairy-farming on second-class bushlands, 98.
 Hams and bacon, mildew and rust on, 292.
 Hay, pressing direct from field, 69.
 High protein content of pasture: Research on suggested relation to dairy-cow diseases, 97.
 Honeycomb cappings, treatment of, by electric oven melter, 321.
 Honey, trouble with, 68.
 Hopkirk, C. S. M.—
 Dairy-cow diseases in New Zealand, 75.
 Blood scour in calves due to coccidiosis, 189.
 Blood agglutination test for contagious abortion, 380.
 Horticulture Division—Latest export examination dates for apples, 72.
 Horticulture (monthly notes), 58, 138, 211, 282, 354, 420.
 Hudson, A. W.—Wheat-manuring experiments in Canterbury, season 1928-29, 337.
 Hyde, W. C.—Horticulture, 61, 138, 211, 282, 354, 420.

I

- Importation of fertilizers in 1928-29, 404.
 Internal parasites of sheep and lambs: Some notes on prevention and treatment, 247.
 Inventions of agricultural interest, 220, 364.
 Iodine test for maturity in apples, 172.
 Iron starvation, cure of, in stock, 232.
 Iron treatment for bush sickness, 29.
 Irrigation farming in Central Otago, some aspects of, 150.

J.

- Jersey C.O.R. bull Ngahiwi Silent Knight, 332.

K.

Kidson, E. —

The climate of New Zealand, 40.

Weather records, 70, 143, 216, 290, 361, 434.

King-country, lime-deficient areas in, 260.

L.

Lamb mortality investigation Note on the 1928 season's work, 390.

Land, occupation and utilization of, 190.

Latest export examination dates for apples, 72.

Lawn-mower method for measuring grass-yield, 168.

Leg-louse, sheep, 271.

Leighton, F. T. —

The Fertilizers Act and regulations, 254.

Importation of fertilizers in 1928-29, 404.

Levy, E. Bruce, and Smith, J. M. - Farmers' pasture competitions:

North Taranaki results, 1928, 117

Licensed meat-export works in New Zealand, season 1928-29, 74

Lime-deficient areas in King-country: Top-dressing experiments with sheep at Maeroa, 260.

Lime, mixing of, with fertilizers, 218.

Lime, loss of, from soils, 33.

Lime-rich plant, lucerne a, 397.

Linseed, Bill Moose, 220

Linseed-rust control work, 171.

Live-stock Division—

Prevention and treatment of mammitis in dairy cows, 27.

Caseous lymph-adenitis in sheep, 48.

Licensed meat-export works in New Zealand, season 1928-29, 74

The sheep blow-fly pest, 115.

Skin ulceration in pigs, 153.

Ragwort control with sheep, 169.

The castration of pigs, 200.

The sheep leg-louse, 271

Temporary sterility of dairy cows, 301.

Contagious abortion in dairy cattle, 377.

Stock slaughtered, season 1928-29, 438.

Live-stock production in New Zealand: Review of period 1901-2 to 1926-27, based on standard values and units, 423.

Losses of young strawberry-plants: Investigation in Auckland suburban district, 391.

Lucerne a lime-rich plant: Analyses of Otago samples, 397.

Lucerne root nodules, some effect of fertilizers on production of, 103.

M.

Machinery and engines, farm, 121.

Maeroa, top-dressing experiments with sheep at, 260.

Mammitis in dairy cows, prevention and treatment of, 27.

Manuring of wheat in Canterbury, 271.

Marshall, D.—Some common ailments of pigs, 394.

Maturity of apples in relation to long-storage. Some trials with the iodine test, 172.

McDowall, F. H. Flooring materials for dairy factories, 407.

McGillivray, R., and McKay, J. G. - Ashburton Experimental Farm, season 1928-29, 333

McIlwaine, J. E.—Internal parasites of sheep and lambs, 247.

McKay, J. G., and McGillivray, R.—Ashburton Experimental Farm, season 1928-29, 333.

Meat-export works licensed in New Zealand, season 1928 29, 74

Mil dew and rust on hams and bacon, 292.

Milking shed drainage: Simple pumping method, 46.

Mineral contents of some typical pastures in Waimea County, 304.

Mineral hunger in sheep, 293.

Mineral hunger in sheep: Successful treatment by pellet-feeding method, 10

Minerals in pastures and their relation to animal nutrition (review), 358.

Mixing of superphosphate and basic slag, 365.

Morgan, G. F. V.—

Cleanliness of the cream-separator, 182.

Mottling in coloured cheese, 259.

Mortality among lambs investigation, 390.

Mottling in coloured cheese: Investigation at Wallaceville, 259.

Muggeridge, J.—Biological control of pear-midge (*Pernisia pyri*) in New Zealand, 317.

Muscovy ducks, cross-breeding of, 68.

Mycological investigations abroad, 217.

Mycological investigations at Plant Research Station, 1.

N.

Nasal catarrh in dairy cattle, 146.

Native plants in a New Plymouth garden, 61.

Neill, J. C.—Poisoning of small birds with strychnined wheat, 303.

New Flora and Silva, the (review), 436.

New Zealand Institute fellowships, 127.

New Zealand Plant Research Station: Current mycological investigations, 1.

Ngahiwi Silent Knight, Jersey C.O.R. bull, 332.
 Nicholls, J. E.—Preliminary report on wool research, 257.
 Nodules, lucerne root, 103.
 Northern Wairoa Experimental and Demonstration Farm: Notes on operations in 1927–28, 30.
 Noxious weeds orders, 422.

O.

Occupation and utilization of land in New Zealand, 1927 and 1928, 190
 Official Seed-testing Station, the
 Record of operations for 1928, 323
 Onions, long keeping of, 437.
 Orchards, commercial, 147.
 Orchard-tax Act, 61.
 Orchard, the (monthly notes), 52, 130, 204, 274, 349, 413.
 Otago Central, salty soils in, 250.

P.

Parasites, internal, of sheep and lambs, 247.
 Pasture competitions, farmers', in North Taranaki, 117.
 Pasture, high protein content of, 97.
 Pasture management: Intensive grazing for Canterbury conditions, 177.
 Pasture top-dressing on farms, statistics of, 65.
 Pasture top-dressing results in Wellington Province, 20
 Pasture top-dressings, 365
 Paton, W. N., and Fawcett, E. J. — Live-stock production in New Zealand, 1901–02 to 1926–27, 423.
 Pea diseases, 7.
 Pear-midge, biological control of, in New Zealand, 317.
 Pellet-feeding method for sheep, 10.
 Perennial canary-grass (*Phalaris bulbosa*), 68
Perrisia pyri, 317.
 Phormium tenax, research on, 176, 320.
Phalaris bulbosa, 68.
 Pigs, skin ulceration in, 153.
 Pigs, some common ailments of, 394.
 Pigs, the castration of, 200.
 Plant-food, loss of from soils, 33.
 Plant nutrition and soil-fertility, 47.
 Plant Research Station, 1.
 Plant specimens for identification, 389.
 Poisoning of small birds with strychnined wheat, 303.
 Pope, Mr. F. S., retirement of, 237.
 Potato diseases, 4.
 Potatoes, seed, certification of, in season 1928–29, 367.
 Poultry-farming, cost of starting, 69.
 Poultry-keeping (monthly notes), 54, 134, 206, 277, 352, 416.
 Poultry Station, Wallaceville, 238.
 Prairie-grass and chicory, 218.
 Prevention and treatment of mammitis in dairy cows, 27.

Production, live-stock, in New Zealand, 1901–02 to 1926–27, 423.
 Protein content of pasture, 97.
 Pumice soils, a survey of, 295, 382.

R.

Ragwort, control of, with sheep, 169.
 Rearing of young stock, 366.
 Reid, W. D.—Some effects of fertilizers on the production of lucerne root nodules, 103.
 Retirement of Mr. F. S. Pope, 237.
 Reviews, 66, 213, 358, 436.
 Rice, W. H.—
 Citrus-culture (monthly notes), 54, 133, 205, 276, 351, 415.
 Losses of young strawberry plants: Investigation in Auckland suburban district, 391.
 Rigg, T., and Askew, H. O.—Mineral contents of some typical pastures in Waimea County, 304.
 Root nodules, lucerne, 103
 Rotational grazing on dairy-farms, 272.
Rumex species, 122.

S.

Salt content of butter, 376.
 Salt spray for killing gorse, 147.
 Salty soils in Central Otago: A chemical study of the so-called alkali patches, 250.
 Scott, M. J., and Sidey, D. J.—
 Pasture management: Intensive grazing for Canterbury conditions 177.
 Seasonal notes (monthly), 50, 128, 201, 272, 347, 411.
 Second-growth country, improvement of, 39.
 Seed - potatoes certification: Provisional certificates issued, 1928–29, 362.
 Seed-potatoes, certification of, in season 1928–29, 367.
 Seed-testing Station, the official record of operations for 1928, 323.
 Sheep, blindness in, 437.
 Sheep blow-fly pest, the, 115.
 Sheep, caseous lymph-adenitis in, 48.
 Sheep-dipping, 130.
 Sheep-dipping points, 146.
 Sheep leg-louse, 271.
 Sheep, mineral hunger in, 10.
 Sheep, mineral hunger in, 293.
 Shelter-belts and atmospheric conditions, 246.
 Shelter-belts for the farm, 269.
 Shelter, effect of, on farm crops, 253.
 Shows, 67, 148, 220, 294.
 Sidey, D. J., and Scott, M. J.—
 Pasture management: Intensive grazing for Canterbury conditions, 177.
 Simple pumping method for milking-shed drainage, 46.

Singleton, W. M.—

Testing of purebred dairy cows:
Review of the New Zealand certificate-of-record system in 1928, 154.

Jersey bull Ngahiwi Silent Knight, 332.

Skin ulceration in pigs, 153.

Slaughtering of stock, 1928-29, 438.

Smallfield, P. W.—The farm (monthly notes), 50, 128, 201, 272, 347, 411.

Smith, J. M., and Levy, E. Bruce—Farmers' pasture competitions: North Taranaki results, 1928, 117.

Smith, J. W.—A simple pumping method for milking-shed drainage, 46.

Soil fertility and plant nutrition, 47.

Soils, pumice, a survey of, 295, 382.

Soils, salty, in Central Otago, 250.

Soils, loss of lime or plant-food from, 33.

Some aspects of irrigation farming in Central Otago: Progress of the Galloway Demonstration Farm, 150.

Some common ailments of pigs, 394.

Some effects of fertilizers on the production of lucerne root nodules, 103.

Some pasture top-dressing results in Wellington Province, 20.

Sphagnum moss, 403.

Specimens, plant, for identification, 389.

Statistics of farm machinery and engines, 121.

Statistics of pasture top-dressing on farms, 1927-28, 65.

Sterility, temporary, of dairy cows, 301.

Stock, young, rearing of, 366.

Stomatitis in lambs, 292.

Strawberry-plants, young, losses of, in Auckland suburban district, 391.

Superphosphate, properties of, in plant husbandry, 91.

Superphosphate and basic slag, mixing of, 365.

Survey of pumice soils: The sub-soils of Rotorua County, 295, 382.

Systematic botany, the economic significance of, 399.

T.

Temporary sterility and abortion, absence of correlation between, 346.

Temporary sterility of dairy cows, 301.

Testing of purebred dairy cows: Review of the New Zealand certificate-of-record system in 1928, 154.

Testing of purebred dairy cows (C.O.R. lists), 62, 141, 285.

Tennent, R. B.—

Some aspects of irrigation farming in Central Otago: Progress of the Galloway Demonstration Farm, 150.

Threshings of wheat and oats, 1929 harvest, 294.

Tobacco-culture. notes, 58, 138, 282, 354, 420.

Top-dressing results in Wellington Province, 20.

Top-dressings, pasture, 365.

Treatment of honeycomb cappings: An electric oven melter, 321.

Trees of New Zealand (review), 66.

Tuberculosis in poultry, 277.

Tutu, control of, 437.

U.

Utilization of whey: Economics and technique of concentration, 36.

V.

Vegetation of New Zealand, the (review), 213.

W.

Waimea County, mineral contents of some typical pastures in, 304.

Wallaceville Poultry Station: Description of the plant, 238.

Walnuts, propagation of, 146.

Walnut-trees, raising, 366.

Water-heater, electric, for dairy-farms, 190.

Watery eye, heifer with, 292.

Warty growths on cow's head, 147.

Weather records, 70, 143, 216, 290, 361, 434.

Weeds and their identification—

Apple of Peru, 266.

Three common docks, 122.

Wheat and oats threshings, 1929 harvest, 294.

Wheat-manuring experiments in Canterbury, season 1928-29, 336.

Wheat-manuring experiments in Canterbury: Summary of six years' research and recommendations to farmers, 221.

Wheat, oats, and barley, estimated yields of, 148.

Wheat Research Institute, 316.

Whey paste as a pig-food: Feeding trial at Lincoln College, 112.

Whey, utilization of, 36.

Wilson, R. A.—Some pasture top-dressing results in Wellington Province, 20.

Wilson, Sir James, the late, 336.

Winter grazing of young pasture, 438.

Winter shows, forthcoming, 294.

Wool research, 336.

Wool research: Dr. Nicholl's preliminary report on New Zealand conditions, 257.

Wool statistics, 422.

Wright, C. M.—Lime-deficient areas in King-country, 260.

Y.

Yields, estimated, of wheat, oats, and barley, 148.

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No. 1.

THE NEW ZEALAND PLANT RESEARCH STATION.

CURRENT MYCOLOGICAL INVESTIGATIONS.

G. H. CUNNINGHAM, Government Mycologist, Plant Research Station,
Palmerston North.

THE Plant Research Station was established at Palmerston North last April as the result of an arrangement arrived at between the Department of Agriculture, the Scientific and Industrial Research Department, and the Massey Agricultural College. The present control of this organization is vested in a committee composed of representatives of the two Departments and the College, with, in addition, members representing the commercial and farming interests of the Dominion.

The Station has been instituted primarily with a view to conducting on scientific lines investigations into problems affecting agriculture in its widest sense. Thus all problems affecting the production of agricultural crops and crop products (as seeds), horticultural crops, grasslands, and forest stands (both exotic and indigenous) come within the scope of the Station. At present special attention is being paid to the production of disease-free nucleus lines of pedigree agricultural seeds; to the furtherance of seed-production on a commercial scale; to the extension of seed export; to the systematic study of the New Zealand flora, both phanerogamic and cryptogamic, indigenous and introduced; to the improvement of pastures and pasture plants; and to the study of all plant diseases occurring within the Dominion.

This article deals specially with the plant-disease work at present being undertaken by the mycological staff of the Station. As one of the objects aimed at is the production of disease-free pedigree nucleus lines of agricultural seeds, this phase of the work is closely associated with the work of the Agronomist; for he has first to produce lines of pedigreed seed before the matter of rendering such disease-free can be undertaken. Experience of the past few years has shown that, in New Zealand at least, the annual losses due to plant-diseases are so great that profitable farming is dependent on successful disease-control.

Now, as the majority of diseases of agricultural crops (and others, too, for that matter) are seed-carried, it follows that the best method



FIG. 1. POTATO EXPERIMENTAL AREA AT THE PLANT RESEARCH STATION FARM.

The blanks seen in the plots indicate plants removed during roguing.

[Photo by H. Drake.]

of dealing with such diseases is to eliminate them from the seed. Consequently, if the lines used commercially were disease-free, then not only would the resultant crop be disease-free, but the necessity for practising any seed-treatment would be obviated. Theoretically, in the course of a few years such a practice, if followed up consistently, would result in the elimination of all seed-borne diseases from the agricultural crops of the Dominion, a matter which would not only assist in securing a sound economic basis for farming, but would also result in direct saving of a very large sum of money annually. Unfortunately, the matter is not merely one of treating all seeds with some panacea; for experience has taught that practically each disease requires its special treatment; and it must be admitted that no control is at present known for many. Then again, constant reinfections occur in the field from volunteer host-plants, weeds, soil-contaminations, and the like; from threshing-plants, bags, and other containers; drills and other farm implements. And, what is of greater significance, many of our diseases are annually imported from overseas with the seed. Consequently, before elimination of seed-borne diseases can successfully be undertaken a control has to be evolved for each disease under consideration, necessitating careful work on each and every one attacking our crops; the whole of the farming technique has to be reviewed and possibly revised, and especially provision made for the prevention of entry of imported seeds carrying certain diseases of economic importance.

Such work calls for a completely equipped pathological research station, with laboratories, glasshouses and land, and a staff of specially trained pathologists with adequate equipment. Such has been or is to be provided at the Plant Research Station. Work was commenced in April last, investigations being conducted upon the diseases of cereals, potatoes, peas, brassicas, tomatoes, and certain timber-trees and timbers.

Cereal Diseases.

As the past four seasons' work* has led to efficient control methods with the smuts, work this season has principally been along the lines of combating other major diseases, such as stripe of barley and take-all of wheat.

Barley-stripe (*Helminthosporium gramineum*) is carried with the seed, as preliminary work has demonstrated; consequently control experiments have been directed towards the evolution of a treatment for its elimination, since the hot-water treatment so successful against loose-smut of barley and wheat is not effective against stripe. A large series of different treatments has been carried out, the treated seed being sown on the Station farm. Since practically the whole of the commercial malting-barleys of Canterbury have been rendered smut-free as a result of the practice of the methods at present adopted—that is, by the treatment of nucleus lines, and bulking these subsequently under aseptic conditions—stripe remains the only other serious disease of this crop with which we have to contend.

Take-all (*Ophiobolus graminis*) has proved the most serious disease of wheat in the Dominion, since in certain localities it may cause an annual loss of up to 70 per cent. Despite the amount of investigational

* This and several other branches of mycological work were previously carried out in connection with the Biological Laboratory of the Department of Agriculture, at Wellington.

work being conducted with this disease both in New Zealand and abroad, its life-history is yet but imperfectly known. Although foreign workers have not found it to be seed-carried, our preliminary laboratory and glasshouse experiments conducted have shown that seed taken from take-all areas will, under favourable conditions, produce take-all-infected plants. But, despite numerous experiments, such infected plants have not been obtained in the field. Consequently, work this season has been directed towards obtaining take-all in the field, under natural conditions, firstly to substantiate the laboratory experiments, secondly to supply infected soil in quantity sufficient to enable persistence and host-range studies to be undertaken. Approximately 3 acres have been sown on the farm with seed taken from take-all areas in the South Island.

The rusts of wheat (*Puccinia graminis* and *P. Elymi*), of oats (*P. graminis* and *P. coronata*), and of barley (*P. anomala*), as a rule, appear too late in the season to cause much damage. But, as in certain seasons these fungi may cause appreciable damage, especially *P. coronata* on oats and *P. graminis* on wheat, they will form the subject of further investigation. As a preliminary, the differential hosts used in North America for determination of physiological forms are being grown this season on the farm to provide sufficient material for subsequent work. As all these rusts are heterococious, and as in no case do the alternate hosts occur in New Zealand, it is evident they are perpetuated in some manner other than the customary way; consequently special attention will be directed towards their methods of overwintering.

Potato Diseases.

With the potato crop work has been concentrated upon the production of pedigreed disease-free nucleus lines of commercial varieties. At present some 2½ acres on the farm are sown to pedigreed selections (made by the Agronomist) of all potato varieties grown in the Dominion, for the purpose of eliminating from them diseases which are carried with the tuber. As all potato-diseases present in New Zealand are tuber-borne, the problem of producing nucleus disease-free lines becomes one of intensive rogueing, together with a system of tuber-treatment for those diseases which may be combated in this manner. In addition the methods by which the diseases may be spread in the field, or may be carried from one season to the next, are being investigated so that precautions can be taken to minimize contamination of the disease-free lines from extraneous sources.

Potato-diseases fall into three fairly well defined groups: (1) Those which are responsible for "blanks" and stunted plants; (2) those which cause wilt and death of plants in the field; (3) those which cause a general reduction in yield.

Of the first group, corticium disease (*Corticium Solani*) is of the greatest economic importance, since it is present in practically every line grown and takes a considerable annual toll. Its effects are noted shortly after the majority of the plants have come well above the ground. Certain plants in the rows either do not appear at all, or send up a few spindly, weak, and late shoots. If the tuber is lifted at this stage it will be seen that most shoots show cankers near the tuber, many of which have cut off the top of the shoot, causing fresh

growths to appear from beneath the point of infection. Sometimes this may happen four or five times; consequently the shoots are much delayed, and often killed outright. Hence the small size of such plants and the frequent "blanks" in the rows.

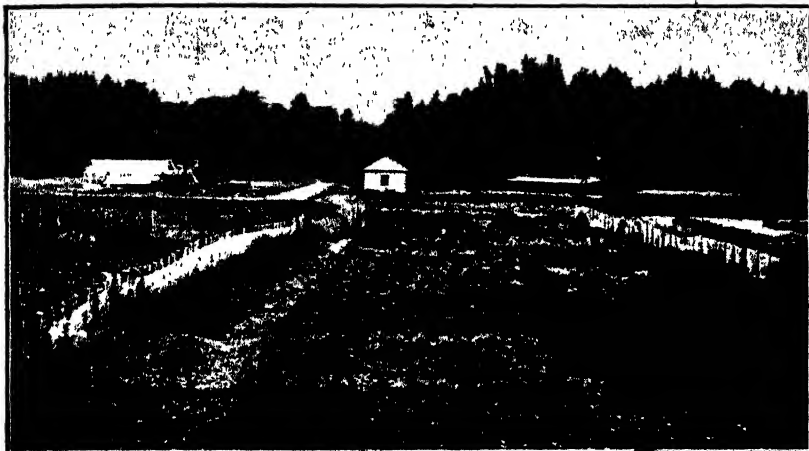


FIG. 2. THE PEA AREA, WITH PICKING OPERATIONS IN PROGRESS.

In distance, glasshouse, steam sterilizer, implement-shed, and insect-proof cages.



FIG. 3. EXPERIMENTAL BARLEY AND WHEAT PLOTS (ON LEFT); CORTICIUM AREA (IN FOREGROUND); PEA COLLAR-ROT PERSISTENCE AREA (MIDDLE DISTANCE); LINSEED (IN DISTANCE ON RIGHT).

[Photos by H. Drake.

As a result of previous work a treatment had been evolved for the control of corticium. Although this has not proved a practicable one for farmers, it has been used successfully for eliminating this disease from all the pedigree lines now growing on the Station farm.

Previous experiments in the control of corticium disease tended to show that the disease may possibly carry over in the soil from season to season, and this has led to conflicting results being secured in control experimental work. Consequently a series of experiments has been planned to determine whether the disease does really carry over in this manner; and, if so, whether any rotational, manurial, or soil treatment will tend to shorten or eliminate this period of persistence. For this purpose 1 acre has been planted with tubers known to be infected with corticium disease, with a view to infecting the soil, to enable subsequent experiments to be undertaken. Experiments on these lines have been planned to cover four seasons.

The diseases of the second group, usually termed "wilts," are due to the following organisms: (1) Vascular wilts (due to one or more species of *Fusarium*); (2) mattery-eye (a bacterial disease due to *Phytophthora Solanacearum*); (3) sclerotium disease (due to the fungus *Sclerotinia sclerotiorum*). Their presence is shown by sudden wilt of the foliage of one or more stems, followed by death of the part affected, or often of the whole plant. Often the tubers show a brown discoloration in the vascular ring, but this is not a definite character, since it may be due to other agencies. Nevertheless, when such discoloration is noted it is an indication that the tuber is diseased; consequently such tubers should not be planted for seed. Mattery-eye is expressed in an aggravated form, wilt of the whole plant being rapidly followed by its death; the tubers show a strongly discoloured vascular system, and in addition often decay rapidly, emitting at the same time an unpleasant smell similar to that of decaying fish. The vascular wilts are present in most commercial lines to the extent of between 10 and 20 per cent.

The third group contains what are now known as virus diseases. Such are not due to bacterial or fungous agency, but to some infective principle, the nature of which is at present unknown. Virus diseases are transmitted in the tuber, and may be carried from plant to plant by insects such as aphids. Consequently if clean seed is used, and insects vigorously excluded from the crop, a clean line may be obtained. This group of diseases may be detected in the crop by their effects upon leaf, stem, and tuber; but, as the symptoms are numerous and complex, a special training in virus work is necessary before rogueing of infected plants can be successfully practised. In New Zealand several types of virus disease are present; but whether these are different diseases, or different expressions of the same disease, is not known, nor is there any agreement among those working on the plant-virus problems. Mild-mosaic, rugose-mosaic, aucuba-mosaic, leaf-drop, stipple-streak, spindle-tuber, curly-dwarf, leaf-roll, streak, and wildings are all present in New-Zealand-grown commercial lines. This group of diseases is chiefly responsible for a very considerable decrease in the annual yield of the potato crops of the Dominion, some lines having depreciated to such an extent that they are commercially unprofitable, producing less than 3 tons per acre; consequently, economically, this group is the most significant of those attacking the potato.

One other disease common on potatoes is late-blight, caused by the fungus *Phytophthora infestans*. This does not fall into any of the groups noted, since it is sporadic in its appearance, being governed by two factors—(1) temperature and humidity of the areas during the growth period, and (2) its presence or absence in the tubers planted in those areas.

Work this season has been directed against the elimination of all diseases enumerated from the pedigreed lines growing on the farm. Next season part of these will be bulked in Canterbury prior to distribution to certain selected growers, and part will be retained on the Station farm for further roguing. During the winter months certain of these tubers will be grown in the glasshouse under control conditions, to enable life-history studies of virus and other diseases to be undertaken under New Zealand conditions.

Pea Diseases.

Two major groups of field-pea and garden-pea diseases have proved serious problems to growers. These are collar-rot (embracing several related organisms) and virus diseases.

Collar-rot is a seed-borne disease, and this season an extensive series of experiments has been undertaken with both field and garden peas with a view to finding a method of control. Field experience has also tended to show that the disease may persist for one or more seasons in the soil. To determine whether such is the case, approximately 1 acre has been sown with a line known to contain collar-rot, with a view to infecting the soil. Should such be the case a four-years course of experiments has been planned to determine the period of persistence, and whether any soil, manurial, or rotational treatment will reduce or eliminate this soil-borne phase.

Pedigree selections of all commercial lines of garden-peas (made by the Agronomist) have been grown on the farm with a view to rendering these free from all seed-borne diseases, such as collar-rot and virus disease. These have been rogued repeatedly, and are at time of writing being harvested. Part of each line will again be grown on the farm for further selection work next year, and the remainder bulked for commercial distribution. Approximately 3 acres of field-peas, of three commercial varieties, have been treated for collar-rot and grown on the farm, the object being to provide sufficient disease-free seed for commercial distribution.

Diseases of Brassicas.

One of the major agricultural crops grown in the Dominion is the brassica crop—turnips, swedes, and rape. Owing to the considerable improvements in pasture establishment and maintenance which have taken place during recent years, the carrying-capacity of our grasslands has been considerably increased. But no improvement has yet been evolved to enable pastures to maintain their maximum carrying-capacity for more than at most three parts of the year. If the farmer wishes to retain the maximum carrying-capacity of his farm the year round (apart from hay or ensilage) it is necessary that he provide a supplementary crop for that period when grass-production is low. Often, too, he requires an additional summer supplementary crop so

that he may "top off" fat stock for the market. Undoubtedly the best supplementary crop is the swede or turnip, and the best summer supplementary crop is rape. But owing to the increasing spread of dry-rot and club-root it is becoming difficult, and in certain localities impossible, to grow satisfactory crops of either. Owing to the great significance of these two diseases, dry-rot and club-root have been made major projects in this and subsequent seasons' work at the Station.

Practically all rape, swede, and turnip crops grown in New Zealand are grown from seed imported from abroad, principally from Britain. Previous work has shown that dry-rot is carried in seed; recent field surveys have shown that it is probable club-root is similarly carried, though European investigators have claimed such is not the case; but the frequent occurrence of this disease in crops grown on virgin land has a significance which cannot be overlooked, despite European work.

Dry-rot. — This season's work consists in ascertaining whether the disease persists in the soil for one or more seasons; and, if so, whether any soil, manurial, or rotational practice will reduce or eliminate such. Land on the farm artificially infected with dry-rotted mummified swede bulbs has been sown with a line of swede-seed found to be free from dry-rot in the laboratory. An insect-proof cage has been constructed consisting of three compartments, each insulated from the others by insect-proof mesh, and below the ground-level for a depth of 2 ft. with zinc sheeting. This has been built on the lines of an entomological insectary, phosphor-bronze netting being used throughout. The function of this structure is to determine under controlled conditions whether swede-seed found to be dry-rot-free in laboratory tests remains free when grown to maturity; whether seed infected with dry-rot will produce diseased plants; and whether such seed when treated with the method recommended by the laboratory will remain dry-rot-free. Such evidence should demonstrate conclusively whether the laboratory evidence that dry-rot is seed-borne is substantiated in the field.



FIG. 4. INSECT-PROOF CAGES IN COURSE OF CONSTRUCTION (TO BE USED IN DRY-ROT EXPERIMENTAL WORK).

[Photo by H. Drake.

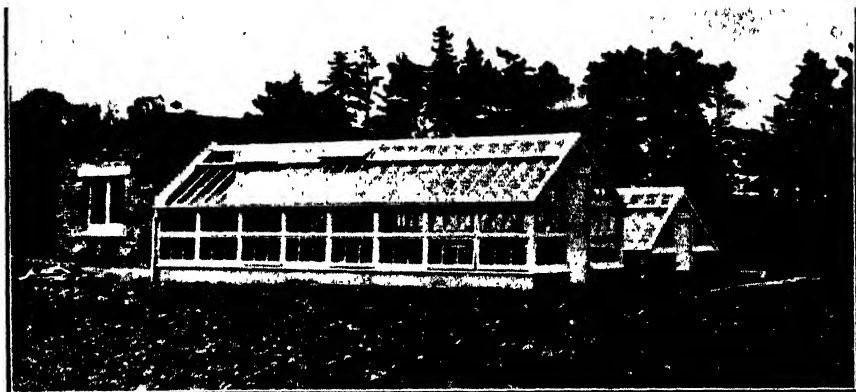


FIG. 5. THE GLASSHOUSES AND ATTACHED WORK-ROOM.

[Photo by H. Drake.]

In addition a commencement has been made to procure certain nucleus lines of swede-seed, disease-free and true to type, as a basis for commercial bulking and distribution ; so that in the event of British seedsmen failing to comply with this country's requirements in the matter of producing dry-rot-free swede-seed sufficient material will be available to enable bulk seed-production to be undertaken within New Zealand.

Club-root.—This disease is known to persist in the soil for several seasons, but the exact length of this period of persistence is not known. Consequently work is being undertaken to determine exactly how many years club-root remains in the soil, and if it is possible by any soil, manurial, or rotational treatment to reduce this period. For this purpose 1 acre has been planted with artificially infected rape-plants, so as to ensure that the land is contaminated with the disease. The duration of this series of experiments is expected to be seven years. The effect of brassica weeds is being considered in connection with this work, since it is possible that one or more of these may tend to carry over the disease indefinitely. Attention is being paid to the possibility of club-root being carried with the seed, numerous box cultures being under way with this objective in view.

General.

Other projects in hand are the investigation of tomato-diseases ; dying of *Pinus radiata* ; manufacture and distribution of cultures of the lucerne nodule organism (sufficient to inoculate 2,500 lb. of seed having been sent out to farmers throughout the Dominion during the past three months) ; investigation of forest nursery diseases ; timber-rots and sap-stains ; and systematics of the New Zealand fungi.

In addition to the insect-proof cages already mentioned, a special pathological glasshouse has been erected, consisting of a series of compartments, each capable of being maintained at one of three constant temperatures. Laboratory and other buildings will be erected at the Station farm as soon as certain particulars concerning structure and appointments are available ; the staff at present is housed in temporary quarters in the town, some distance from the farm.

MINERAL HUNGER IN SHEEP.

SUCCESSFUL TREATMENT BY PELLET-FEEDING METHOD.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

It has been a comparatively easy matter to adjust mineral deficiency in the diet of cows and calves, and to cure suffering stock completely when once the kind of deficiency has been determined. This species of ruminant is more easily treated than sheep for deficient mineral foods, dairy cows and calves being frequently handled or artificially fed or watered, thus giving an excellent opportunity to correct their natural diet by the addition of the mineral in suitable forms, or of drenching them when that extreme form of treatment becomes necessary.

With sheep the difficulty of giving any adequate medicinal treatment will be seen when it is remembered that the treatment does not become obviously necessary until the animals are far gone and so emaciated that weeks of treatment may be necessary to bring them back to health; that they are comparatively little seen and infrequently handled, and roam over a great extent of country of a much rougher nature than that on which cattle are usually pastured; that they water themselves, where they drink at all, from creeks or water-holes; and that they often refuse to take salt licks, even when it is possible to give them the required mineral in that form.

The method which Dr. J. B. Orr and the Rowett Research Institute officials have adopted under somewhat similar conditions existing in Scotland is that of giving the mineral supplement mixed with dry concentrated food, such as oil and meals, pressed into small cube-shaped pellets, each of which contains enough per day for one sheep. Dr. Orr explained the method fully when he was in New Zealand in August last, and after the writer had shown him this Department's rabbit-poison mixer at Frankton Junction, approved of a trial being made with that machine in the making of pellets with material obtained locally. The meals were duly procured, and, after consulting the Geological Survey reports as to the best and cheapest form of native iron-ore to use, one of the minerals required—iron—was located in a suitable form by the writer in a clay-quarry near Auckland. This is the native carbonate of iron (ferrous carbonate) or spathic iron-ore. How the pellets were eventually made will be seen from Mr. Grimmer's appended account; and the credit of finding a method of getting the sheep and lambs to devour, with evident relish, a highly mineralized food, which at first they would rather starve than eat, must be attributed to Mr. Cecil M. Wright, Country Analyst in charge of the Rotorua and Te Kuiti experiments, who describes the method adopted fully.

Further trials will be carried out with the pellets, and until the results are to hand no definite advice will be given on the matter. Should the trials prove successful, the application of the method of supplementing deficient pasture, or what is known as poor hogget country, may mean thousands to the pocket of the farmer. It is not

intended that the method shall affect the necessity for top-dressing sheep-country; but there are farmers who cannot afford to purchase fertilizers, and all over New Zealand there are lands which it will not pay to top-dress. It is under these conditions that the cheapness of the pellet method will appeal to the struggling settler and to the owner of poor country.

Report by R. E. R. Grimmett, Analyst, Chemistry Section, on Preparation of Pellets.

Up to the present, pellets containing minerals have been prepared according to three main formulas, designated Nos. 1, 2, and 3, and are intended for use in three classes of deficiency.

No. 1 is a general mixture of minerals intended as a mineral supplement for animals grazing on herbage of low ash-content where deficiency is not confined to a single element, or in cases where the deficiency has not yet been identified. It may also be of use for breeding-ewes or for hastening the rate of growth of lambs (in both of which cases the demand for minerals is great) on pasture of average mineral content. This mixture is a modification of that used successfully under the direction of the Rowett Institute for sheep on hill country in Scotland. The formula, for one charge of the machine, is as follows. —

Steamed bone-flour	..	..	..	6 lb.	4 oz.
Whiting (calcium carbonate)	..	..	..	7 lb.	14 oz.
Ground spathic iron-ore (ferrous carbonate)	..	..	..	1 lb.	4 oz.
Common salt (sodium chloride)	..	..	..	1 lb.	4 oz.
Sulphur	..	..	..	1 lb.	4 oz.
Potassium iodide	..	..	..	2.75	grammes.
Copra (coconut-meal expressed)	..	..	..	8 lb.	2 oz.
Rice-meal	..	..	..	3 lb.	2 oz.
Peanut-meal	..	..	..	7 lb.	8 oz.
Flour	..	..	..	4 lb.	0 oz.
Cod-liver oil	..	..	..	1 lb.	0 oz.
Anise	..	..	..	..	To flavour.

The purpose of the oil is primarily to prevent the pellets becoming too horny when dry. In addition it is stated to assist the assimilation of the minerals, particularly calcium and phosphorus. The mixture of the meals is intended to increase palatability as well as to obtain a suitable crumbly consistency, and may be modified as found desirable.

No. 2 is an experimental mixture designed to prove whether calcium deficiency exists, apart from phosphate deficiency, in areas where both constituents are low in the pasture and the soils show marked deficiency of lime. The field-work has not yet reached the point of elucidating this point. The mixture consists of—

Whiting	..	..	..	35 lb.	0 oz.
Common salt	..	..	..	2 lb.	8 oz.
Copra	..	..	..	32 lb.	8 oz.
Flour	..	..	..	12 lb.	0 oz.
Cod-liver oil	..	..	..	4 lb.	0 oz.
Anise	..	..	..	..	To flavour.

No. 3 is a mixture designed to supply iron to sheep grazing on the iron-deficient pumice lands. It consists of—

Iron ammonium citrate	..	..	..	2 lb.	8 oz.
Copra	..	..	..	24 lb.	0 oz.
Flour	..	..	..	16 lb.	4 oz.
Peanut-meal	..	..	..	9 lb.	0 oz.
Cod-liver oil	..	..	..	2 lb.	8 oz.
Anise	..	..	..	..	To flavour.

The pellet-making machine is a converted poison-mixer, fitted with a new end-plate having 1 in. holes, and with pipes for supplying steam. The minerals, meals, and oil are mixed dry, water is added until the mixture is crumbly, and steam is then admitted with further mixing until the mass is thoroughly hot and coherent. It is then forced through the holes, suitable adjustment of the cutters giving pellets about 1 in. long. These are spread out on trays, sprinkled with anise, and set in the sun to dry. After air-drying, they are further dried and lightly toasted in an oven to prevent the growth of moulds.

Dose: The pellets when dry weigh about $\frac{1}{8}$ to $\frac{1}{4}$ oz. each, depending on the mixture. The number of pellets required at a time will depend on the frequency of the feeding and the liking the animals have for them, as they may not always eat a full dose. About $\frac{1}{2}$ oz. to 1 oz. of Nos. 1 and 2 (two to four pellets) and 1 oz. to 2 oz. (five to ten pellets) of No. 3 should be sufficient, if fed each day or each alternate day. What the lowest effective limit may be, however, is not known. It is hoped that this point may be determined in the course of the experiments.

Report by C. M. Wright, Country Analyst, on Pellet Method of Feeding Minerals.

The feeding of minerals other than by licks and top-dressing has been successfully and extensively tried in Scotland and Kenya Colony. The idea is to incorporate in a mixture of meals and oils the mineral or minerals known or suspected to be lacking in the pasture the stock are eating, when top-dressing has not successfully dealt with the malnutrition trouble, and also to stimulate the glands to do their work better by the administration of iodine. Even though there may be no suspicion of deficiency of iodine in the pasture it may stimulate the absorption by the animal of certain other elements. The food, which is made up in the form of pellets about $\frac{1}{4}$ in. square, has proved to be an economic proposition as regards cost in both Scotland and Kenya Colony, and there is no reason why it should not be so in New Zealand if farmers are prepared to give the time necessary to train the stock up to taking the food.

It is not suggested that there will be any lessening of the necessity for top-dressing, which is essential for the improvement of grass and carrying-capacity, but it is thought that pellet feeding will be the means of keeping stock healthy until it can be done by means of top-dressing, and for rough country which it is not possible to top-dress. Experiments with top-dressing are necessarily lengthy and comparatively costly, and entail a large amount of work before the desired result is obtained; it is hoped that while those experiments are in progress the pellet method will fill the gap by curing malnutrition, and also help the farmer financially to purchase top-dressing material.

The method of feeding the minerals in pellet form, being a new one in this country, was naturally viewed at first in a critical light, as it was thought that to get stock habitually fed on pastures all the year round to take the food in a different way would be a very difficult thing to accomplish. This difficulty was admitted by Dr. Orr, who stated that it had taken about a year to get the hill sheep in the Highlands to take the food, but that when they had become accustomed to it they would eat the pellets from the shepherd's hands. This entailed a large amount of patience on the part of the shepherds, but the results justified the work and time. It was at first thought necessary that the stock being dealt with should be mustered, and either held or yarded so that they could get the pellets every day until success was obtained. This would seem in New Zealand to be an impossibility; but it is now evident that if some sheep in the flock are educated to take the pellets they will entice others to do the same.



FIG. 1. SHEEP FEEDING AT TROUGH IN YARD ON FARM NEAR ROTORUA.
The nearest ewe has a pellet in her mouth.



FIG. 2. SHEEP EATING PELLETS FROM TROUGH IN Paddock.

The animals were driven into a corner and went readily to the trough. Note abundance of grass.

[Photos by C. M. Wright.]

When it was decided to try the method here, the areas where stock were suspected of suffering from mineral starvation were naturally deemed most suitable, and experiments have been put under way in several localities. The most successful results so far have been obtained on a farm near Rotorua. It is mostly due to the interest the owner has taken in the work, and to the patience of his manager, that in a comparatively short time the sheep have taken to eating the pellets, and will now greedily eat them even when scattered on good grass in the paddock.

At first No. 1 pellets were used on this farm. These were a general mixture containing a proportion of spathic iron-ore (ferrous carbonate). The sheep, which were mostly ewes from six-tooth upwards and obviously not thriving, were shut up in a shed with the pellets in a trough, and although they were kept there till it was deemed advisable to let them out owing to starvation, they would not touch the pellets. The pellets were then removed, and chopped-up turnips were substituted in the trough, and these were eaten readily by the sheep. Pellets were then mixed with the turnips and were also eaten, and the quantity of turnips was reduced and that of the pellets increased till pellets only were fed, and were eaten by the sheep from troughs in a small yard. When the animals were accustomed to the troughs outside, these were removed from the yard and put in a paddock; the sheep were then mustered and held there, and they went to the troughs without any trouble. Next, the pellets were scattered on the grass, and now the animals will eagerly search for them on the pasture. A little aniseed-oil is added to the pellets, the idea being that once the sheep get used to the smell of the anise they will more readily smell the food when it is scattered on the pasture, and this appears to be the case.

The sheep used for this experiment were very light, and could easily be held up one on each arm. Most of the ewes lambled after the experiment had been going for about a month, and at time of writing even the lambs are eating the pellets and appear to be going along quite normally. Both the owner and manager state that had the sheep not had the mineral food they would have been dead long ago. Towards the conclusion of the experiment, which has been going on since the middle of September last, the No. 1 pellets were replaced by No. 3, which are simpler in composition, containing only the necessary iron compound.

Further experiments with sheep are now being started at Kopaki, where, in addition to pellet feeding, certain lick experiments will be tried. Pellets are also being fed to dairy cows, in the malnutrition areas with the idea of increasing the butterfat yield.

Conclusion.

The writer regards the development of the pellet system of feeding minerals to stock as very important. It depends primarily on the fact that all animals are imitative and intensely curious, and that if a limited number of individuals can be taught to eat a new food the whole flock or herd will soon acquire the habit—with advantage to themselves and their owners. With proper machinery the proportion of the more expensive meals in the food can no doubt be reduced. The cost at present is therefore much higher than it will be when larger quantities are dealt with and greater efficiency in the manufacture is evolved. When it is considered that farmers are even now asked to pay £18 per ton for some manures, it appears that even £35* is not too much to pay for a ton of a food all the organic nutrients of which are easily digestible and of which the inorganic part is a mineral

* It is hoped to halve this figure eventually.



FIG. 3. LAMBS EATING NO. 1 PELLETS.

The lamb on right had been very sickly from birth, but was picking up at time photo taken.

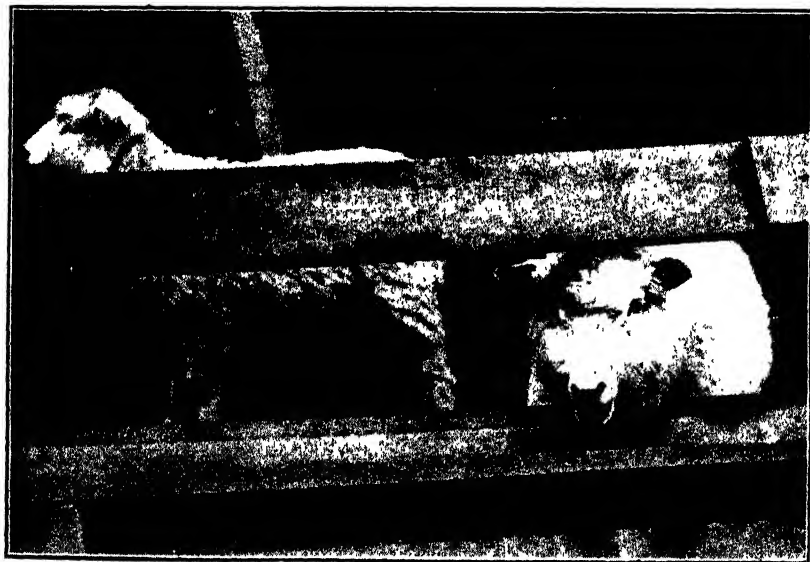


FIG. 4. LAMB WITH PELLET IN MOUTH AT TROUGH.

[Photos by C. M. Wright.]

manure, the greater portion eventually being redistributed on to the land in the dung and urine of the stock.

A ton of the pellets will be sufficient to treat a thousand sheep for over a month, allowing one pellet per day each. The experience of the Rowett Institute is that although some sheep may eat more than their share one day, the next they get less, so that the average is what is required to be given to each sheep. This is a great improvement on the lick treatment, which is difficult to contrive so that each animal will get a fair share, and also because some animals will never take the lick. The accompanying photos, especially Fig. 2, showing the sheep greedily searching for the pellets, indicate that there will be little difficulty in getting every animal to take them.

BLACKBERRY CONTROL BY GOATS.

STRIKING SUCCESS ON A HAWKE'S BAY STATION.

H. GUTHRIE-SMITH, Tutira Station, Hawke's Bay.

THE local origins of the blackberry in northern Hawke's Bay are Petane and Tangoio, where in the "seventies" hedges of this terrible weed had already been planted. On Tutira in 1882 there grew a few scattered plants, which, be it said to our credit, were there and then dug out; in fact, though neighbouring properties became gradually overrun, Tutira was practically clean of blackberry until the war.

Then, during the period between 1914 and 1919, certain areas on the station "got away." Owing to the shortage of men in New Zealand it was impossible longer to dig out the scattered bushes. These—in 1914 probably insignificant seedlings or actually not yet dropped by birds—increased both in numbers and size. By the end of the war they had possessed themselves of a valley or gorge facing south and of another locality facing east, the one of 150 acres, the other of double that extent. This country had mostly been under light bush.

When in 1919 I returned from the Old Country I was horrified and astounded at the state of the run. There were enormous blackberry bushes actually on the homestead lawn; there were 5-ft.-high thickets on the swamp lands, where blackberry had been unknown; on every eligible site individual thriving plants had established themselves. The two areas already mentioned had got far beyond the spade; ploughing or spraying with poison were alike impossible, because of landslips, limestone boulders, and dead timber.

Prior to the advent of goats the methods of defence adopted were digging, poisoning, ploughing, chipping, superphosphating, and salting. Of these digging is the least expensive and most satisfactory where only scattered bushes exist; indeed, even before the coming of the goats nine-tenths of the run had been thus cleared—a man having been put on with orders to the manager that nothing short of murder and arson was to call him off his job. The time taken in digging out a bush varies, of course, with the soil and situation, but the first work is the

heaviest. A blackberry bush 8 ft. by 8 ft. will take an expert eight hours; at a second handling of the soil half an hour; at the third, ten minutes. After that, until grassed over, two or three further inspections are necessary to pick out odd rootlets and seedlings. The great bulk of the hill country on Tutira is now clean, and was cleaned by spade and fork.

On the alluvial swamps, where dry enough, the largest patches were ploughed out—a comparatively easy task, for the roots on good soil do not penetrate deep; the bruising and tearing, moreover, of its root-system seems to hurt the plant more than the clean cutting of the spade. Elsewhere on the swamps poisoning with arsenic and weedkiller was the means employed. The difficulty was to get the poison at all seasons of the year to the spots required; the flat lands from time to time becoming impassable to horses, sledge, and barrel through continued wet weather, the plant badly crippled then obtained a new lease of life. The danger to stock, especially cattle, was, moreover, considerable. One tin from which perhaps a drop per hour of weedkiller had been escaping cost the station six bullocks. On another occasion I lost eight round a single newly sprayed bush. The smell of arsenic-withered leaves and tendrils attracts cattle from miles around.

I may say here that except to destroy the greenery I have found all such cures for blackberry absolutely worthless. Even greater waste of energy was chipping the young shoots as they appeared. The cost of salt and saltpetre was prohibitive—in the end it cost more than spade work. Superphosphating blackberry I have tried only as an interesting experiment, and when experience of goats had made me comparatively careless as to the result. Blackberry will get out of hand with sheep alone on land wintering five sheep to the acre, but whether sheep alone on superphosphated light hill soils would keep blackberry in check I do not know. If the land was sufficiently barren and miserable probably they would.

These various attempts at control were made elsewhere than on the main plaguespots—the patches of fallen bush already mentioned. There for several seasons gangs of Maoris were employed annually to cut the bushes level with the ground. This had the effect of metamorphosing the cone, into which in the open the natural bush develops, into a creeping star, the terminal bud of each ray rooting early in March. I have calculated that each season the blackberry thus cut—for in practice no scythe would get the flattest shoots—more than doubled its size. In the end, to make a long story short, the station was paying many hundreds of pounds a year in labour almost absolutely unproductive, the blackberry area was fast increasing, and the difficulty in obtaining men for this particularly distasteful job was getting more pronounced.

THE GOATS AND THEIR WORK.

I had heard of goats and the work done by them, but as in graver matters fear of the unknown makes us unwilling to test new methods, so for months I boggled over their purchase. However, goats finally were bought about seven years ago. Several of the small lots acquired were well-bred Angora; the others the very refuse of the race—terrible

looking brutes of every colour, size, and make. Year by year this unprepossessing herd has increased, only the best male Angora kids being retained as billics, and fast the flock is becoming white. We have now six hundred mature goats—an ample supply for our requirements—and this year got over two hundred kids. So far no attempt to utilize the fleece has been made, but at next docking the best will be roughly taken off and bagged.

Since arrival of the goats the annual cutting of the blackberry has altogether ceased. The bushes on the twin plague-spots—portions of 700-acre and 800-acre paddocks—are now browsed flat. At first some care was exercised in barking the goats back to these infested corners, but after a week or so the newcomers settled down, and since then have been left pretty much to their own devices. In summer they somewhat spread out to search for and devour the prickly tops of three or four species of thistle growing on the run; in autumn and winter they contract their range and confine themselves to a diet of hard thorny stems. I have reason to believe that during their summer excursions any outlying lawyer or blackberry discovered is never afterwards forgotten. No doubt the goats do take a certain amount of grass, but the area of land kept open by them and now also grazed by sheep more than makes up for the pasturage devoured. They prefer, in fact, blackberry, lawyer, and coarse hard herbage to the best grasses. I have known a mob pass over newly laid down grasses and clovers of two or three inches high—excellent sheep feed—to reach the roughest of herbage. Scattered blackberry bushes on the rich alluvial flats are more than held in hand; I have no doubt whatsoever that even blackberry in lucerne would be discovered and nibbled back. Certainly, too, goats eat much seedling manuka of an inch or so in height; they also trim the bigger bushes.

At first I did not care to see goats in every paddock, but nowadays we let them go where they like, sure that they can do no harm; and sure, too, that any seedling blackberry that may have escaped human eyes will never be allowed to grow more than an inch or so in height or spread. They are the police of this countryside; they arrest all sorts of vegetable ne'er-do-wells. We are glad to see them establishing themselves in paddock after paddock.

The success of the goat as a blackberry destroyer is the more remarkable in that—on Tutira at any rate—the most virulent and luxuriant growth of *Rubus fruticosus* is to be found on steep aspects, hillsides facing due south and therefore damp, cold, and almost sunless throughout the winter months. There, nevertheless, goats do most congregate, and there they have nibbled the bushes as box edgings are trimmed by garden shears. This means in practice that maybe by an inch or so a year the bushes in the most extremely wet places do enlarge themselves. Any big bush, however, thus increasing becomes also a mass of dead cane, and will burn readily in spring or during a spell of summer heat. It can then be blackened to ground level and the process on the weakening plant start again. So much is blackberry being hampered that I am beginning to think that on heavily goat-stocked land the plant may eventually altogether disappear.

So far there is a local demand for goats, but what eventual use will be made of the several hundred thousand that will be required permanently in this part of Hawke's Bay I know not. To shear them entails the risk of a cold snap, and goats are far less hardy than sheep. And although our flock spends the year roaming where they will, as the expression goes, "up to their eyes in feed," they do not show commensurate results in weight. I know of only one wether fat enough to kill, and some of the Toggenburg and Anglo-Nubian crosses are very greyhounds in their lenten leanness. I confess, however, that neither shearing nor fattening have been much in mind—we have been content to regard goats as mere animated scythes. They give no trouble in mustering; except at docking-time, the mixed mob of sheep and goats is given a few minutes at gateways when they separate themselves naturally—the goats being allowed to draw off and return to their good work. So far, in a climate of $55\frac{1}{2}$ in. average rainfall, no foot-rot among goats has troubled us.

CONCLUSION.

To reiterate: Since the stocking of Tutira with goats at the rate of 60 per 1,000 sheep scything and poisoning of blackberry have altogether and absolutely ceased. Spade work, too, has been stopped in paddock after paddock; now, indeed, it is practised only in the hedges and plantations of the policies, where, however, already the number of seedlings brought by birds is sensibly diminishing. The 6 per cent. of goats carried has made no difference in the feed available for sheep. In paddocks of six and seven hundred acres goats work the blackberry areas without shepherding. During the winter months goats crowd on to the cold wet steep sunless southern slopes. Goats are reasonably amenable; they give no trouble in mustering, and stay put to a much greater extent than would appear probable from their known activity. They do jump fences and they do straggle, but when brought back they remain. At the worst they are no worse than Merinos; indeed, in my recollections they are less restless and wild than this breed of sheep. Nor must it be thought that only large areas of ground can satisfactorily be treated with goats. Several of the settlers in this neighbourhood on 800- and 1,200-acre farms are making a good job of the pest, and so flattening to the earth the horrid cone-shaped excrescences that the countryside is in appearance improved out of all knowledge. Sections that have until lately been regarded as practically worthless will again support settlers.

The stocking of Tutira with goats to the extent of 60 per 1,000 sheep has been in my estimation an unqualified success. I do not see how this method of blackberry control can be bettered.

Importation of Animal-manures from Australia.—An Order in Council gazetted on 13th December, 1928, prohibits the introduction into New Zealand of animal-manures from the Commonwealth. This follows the recent withdrawal from Australia of the Agriculture Department's system of inspection, consequent on the gradual shrinkage of the trade to very small proportions. The trade in the past was principally in bonedust, ample supplies of which are now manufactured within New Zealand.

SOME PASTURE TOP-DRESSING RESULTS IN WELLINGTON PROVINCE.

R. A. WILSON, D.S.O., Marton.

A REMARK made by a Rangitikei farmer that "top-dressing has revolutionized farming in the district and has altered nearly all our preconceived ideas and practices, and we are only just beginning to learn our farming afresh," sounds an exaggerated statement when first heard. Consideration will show, however, that the revolution which is being accomplished is so striking in its results that there is much truth in the remark.

The basic reason for the rapid extension of top-dressing is the high value of the return obtained compared with the cost of the fertilizer and labour used to produce it. The figures as quoted later (ignoring the value of the by-products such as wool and the cost of application) show that one farmer has increased his annual production of fat lambs by about 700 by applying annually 30 tons of super-phosphate. This, at £5 a ton for the super and 25s. a head for the fat lamb, means that a return of £875 has been secured at a cost of £150. To put it another way, an increase of 700 lambs has been secured at the cost of 120, or about 17 per cent. of the return. Looking at it in yet another way, it has taken about 30 tons of manure at £5 a ton to produce about 11 tons of lamb selling at £75 or £80 a ton.

On my dairy farm at Himatangi the figures as quoted later show that an application of 15 tons of manure annually has produced an increase per annum of about 4 tons of butterfat, which sells at the present time at about £150 a ton. This is about the same proportional result in weight as just given for fat lambs.

In the case of wool, however, the profit would not be nearly as great, as, though it sells at a high price per ton, the amount of manure required to produce a ton of wool is much greater than with lambs or butterfat. Any fall in price, of course, in fat lambs or butterfat would decrease the profit commensurately. When fat lambs were first put on the market in this district about twenty years ago their value was not more than 10s. per head, and though a profit on top-dressing could be shown even at this figure it would not be nearly so great as under present values. Assuming the cost of manure to be the same, it would take 300 of the increase to pay for the manure, or about 43 per cent. of the return, if lambs sold at 10s. each.

The above figures are, of course, not meant to show that a net profit of these surpluses of return over expenditure is being made. In the case of fat lambs there is the cost of the ewe to be considered, and in the case of the dairy cow the labour of milking to be provided for, and before a balance could be struck in either case many other factors would have to be allowed for. These considerations do not, however, affect the main issue—namely, that top-dressing is profitable.

I am able to give (Table 1) some data from a Marton farm on heavy clay land with an area of 490 acres for the years 1921 onwards, when top-dressing was commenced. In 1921 about 100 acres were

under grain crop, while in 1928 the area had dwindled to about 40 acres under wheat and oats and 20 acres in swedes. The figures represent the number of ewes wintered on the property, and every year over 100 per cent. of lambs have been reared and fattened. The total number of fat lambs sold is not given, as different lots of lambs were bought in and fattened occasionally, which would vitiate the comparison.

Table 1.

	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.
Ewes wintered ..	630	653	950	1,000	1,050	1,200	1,300	1,532
Tons manure used ..	Nil	12	11½	19½	22½	24½	29½	37½
Cost of manure ..	..	£115	£85	£141	£154	£156	£132	£196
Increase in ewes wintered ..	..	23	320	370	420	570	670	902

Except for 1922 the great bulk of the manure used has been 44-46 per cent. superphosphate. During this period also draining has been proceeded with, though not on a very extensive scale.

This table brings out a fact which is being recognized more each year—namely, that the effects of top-dressing with phosphates are cumulative. Though the quantities of manure used have increased, it will be recognized it would have been quite impossible to winter 900 more ewes in 1922 even if the amount of 37½ tons applied in 1928 had been used. There also has been such a steady increase that there is nothing to suggest that the limit of carrying-capacity has been reached under the system.

Some particulars for my own dairy farm at Himatangi will now be given. I started dairying in 1921 with a herd of twenty-five heifers. The herd, which is grade Friesian, has been running on practically the same area all the time, but more land has been brought in as the lake which borders the property has been lowered by draining. Probably the land grazed over by the herd has increased from about 110 acres to its present area of about 150 acres, and I estimate that without top-dressing the area would produce between 5,000 lb. and 6,000 lb. butterfat per year. This is a light sandy soil with the water-level close to the surface, which in a dry season helps considerably to keep the pastures green. Until top-dressing was applied it was looked on as poor land unfit for dairying.

The following analysis of the soil by the Chief Chemist, Department of Agriculture, shows the mineral content calculated on the moisture-free sample :—

Table 2.

Location.	Volatile Matter on Ignition.	Total Nitrogen.	Lime (CaO).	Magnesia (MgO).	Potash (K ₂ O).	Phosphoric Acid (P ₂ O ₅).
Lot No. W. 1379, Himatangi	3.1	0.075	1 per cent. Citric-acid Extract. 1.155 | 0.052 | 0.016 | 0.003			
..	..	..	Hydrochloric-acid Extract. 3.41 | 0.69 | 0.35 | 0.01			

This brings out clearly the phosphate deficiency and explains the response which the land gives to phosphatic top-dressing. There is a large area of sandy soil round Himatangi which shows a similar response, and some remarkable figures for top-dressed farms have been obtained in the locality. For example, Mr. Shailer's herd under herd-testing conditions has shown an average return of over 400 lb. per cow for two years, the figures being 410 lb. and 394 lb. respectively.

The figures for my farm are as under:—

Table 3.

	1922-23.	1923-24	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.
Number of cows milked	25	35	44	51	54	60	70
Tons manure used ..	..	5	7	Nil	12	18	20
Cost of manure ..	..	£35	£46	Nil	£75	£83	£100
Pounds butterfat produced	3,000	5,048	8,657	9,617	13,065	15,972	..
Average factory return per cow (pounds butterfat)	120	144	196	188	242	266	..
Average price per pound	1s. 6d	1s. 5d.	1s. 6d.	1s. 5d.	1s. 3d.	1s. 6d	..
Total return ..	£223	£356	£633	£666	£820	£1,197	..

Here is seen again the cumulative effect of the top-dressing, and here again the steady increase suggests further progress. It will be noted that this season seventy cows are being milked. The average return per cow has steadily increased, except in the season 1925-26, when no top-dressing was done. The slowing-down of the increase that year is also noticeable. The manure used has been mostly half super and half Nauru phosphate. If no Nauru had been used probably a still more noticeable lag would have been shown for the year in which no top-dressing was done.

One of the most remarkable effects of the top-dressing has been the complete change in the composition of the pasture. About one-third of the area was ploughed and laid down to English grasses, but the remainder when dairying commenced was chiefly weeds and sedges, being the natural growth that sprang up when the lake was drained. A portion was top-dressed as an experiment, and the results were so good that the whole of the area was top-dressed annually. The weeds and sedges have now given way to a thick growth of clovers consisting of white clover, strawberry clover, Lotus major, suckling clover, and trefoil or *Medicago lupulina*. A few pounds of Lotus major and a very small quantity of strawberry clover had been sown on the edge of the lake some years previously, but were not very noticeable. With top-dressing they both increased very rapidly, and, though sometimes covered with water in winter, these two form a complete mat in the wetter places and give a splendid lot of feed in the autumn when the pasture on the drier portion is going off. This self-sown area is now too good a pasture to plough up. The only drawback is that as there are few grasses in the pasture it does not come away very early in the spring and probably is not so balanced a ration as the paddocks sown down to English grasses, which have also steadily improved each year.

Following also are some figures of the returns from a dairy herd milking on a property of about 170 acres at Rangataua, on the Main Trunk line. This district has a cold winter and a short dairying season, and returns are consequently much lower than at Himatangi, though they can doubtless be increased by consistent top-dressing. The farm is on a light volcanic soil about ten years out of bush, and showing signs of deterioration.

Table 4

	1923-24	1924-25	1925-26.	1926-27.	1927-28.	1928-29.
Number of cows milked ..	26*	33	2 J	40	40	50
Tons manure used ..	..	..	3	3	7½	12
Cost of manure ..	..	..	£19	£18	£35	£60
Pounds of butterfat produced	3,000	3,607	3,790	6,041	6,165	..
Average pounds per cow ..	115	112	131	151	154	..
Average price per pound ..	1s. 4d.	1s. 4d	1s. 5½d.	1s. 2½d.	1s. 4d.	..
Total return ..	£199	£246	£277	£364	£410	..

* Heifers.

The top-dressing here, which has been mostly with superphosphate, has not been under way long enough to judge of the full effect; but the response is marked, and the extra return has repaid the cost of the manure several times over. Here also the return per cow is going up, and with steady manuring a cumulative effect may be expected.

I have not included the cost of application in the foregoing comparisons, since in each case the manure was applied by the ordinary labour of the farm and the cost is difficult to estimate correctly as a basis of comparison. However, it may be said that on level, easy country the manure should be applied by a distributor at a cost of 1s. 3d. to 1s. 6d. per acre. When sown by hand, contract labour will undertake the work in hilly country at from 2s. to 2s. 6d. per acre, according to the amount sown; the usual price is 17s. 6d. to £1 per ton when the manure is packed over to convenient points for the sower to reach. The packing by horses would probably run about 5s. to 10s. extra per ton, according to the distance from the delivery-point by road. In sheep-country at a distance from the railway, however, the carting by road is often more expensive than the packing and sowing, as if the farm is distant—say, fifteen to twenty miles—the carting may cost up to £3 a ton, though sometimes when back loading can be arranged it may be done for £2 a ton. On country easily reached by motor-lorry and a few miles from the rail the carriage would not cost, of course, more than 7s. 6d. to 10s. per ton.

The three instances given of three different types of soil in localities widely separated, all show remarkable response to phosphates, and it may be said that any one dairying or growing fat lambs in this province is losing money if he does not top-dress his pastures. Some farmers say they cannot afford to top-dress, but this shows a want of clear thinking, as they really cannot afford *not* to top-dress. The return from dairying or fat lambs is so immediate that every farmer, unless he is in a very unsound financial position, can obtain credit for manure for the short period before it pays for itself.

DISTEMPER IN DOGS.

RECENT RESEARCH WORK ON IMMUNIZATION.

Lecturette by D. A. GILL, M.R.C.V.S., D.V.S.M., Assistant Officer in Charge, Wallaceville Veterinary Laboratory, broadcast from Radio Station 2YA, Wellington, November, 1928.

DISTEMPER, which is one of the most widespread as well as the most devastating diseases affecting dogs, has carried off a great many victims in this country. Besides the distress caused by the loss of pets, it has hit a good many farmers very heavily in robbing them of dogs which cost a considerable amount in the first place and on which much time and labour had been spent in suitable training. On many sheep-stations about two years ago, when there was an unusually large amount of distemper about, almost all the dogs on the place died of it.

My main purpose is to tell something of the research work that has been done in the last few years on distemper, of the excellent progress that has been made, and of the great hopes we have of being in a position to immunize dogs against the disease and so prevent these losses. Some five years ago *The Field*, a weekly paper in the Old Country, opened a subscription list called *The Field Distemper Research Fund*, with the object of getting a sufficiently large sum of money to thoroughly investigate the matter. The actual research work has been carried out by Dunkin and Laidlaw, the former a veterinary surgeon and the latter a medical man.

Their first job was to obtain a kennel of dogs that were absolutely free of distemper, and this was a matter of great difficulty. Special kennels had to be built in which dogs could be bred without contact in any way with the outside world, so that the investigators would know that their experimental animals were free from the disease and therefore susceptible to it. Just how necessary that was, and how rigid are the precautions taken to avoid infection being accidentally introduced to the premises, may be imagined from the fact that not only are visitors strictly limited, but that every one entering has to go through three rooms. In the first room they undress, in the second they have a bath, and in the third they put on sterilized clothes. When a dog is required to be infected it is removed from the clean kennels to a separate establishment elsewhere in the grounds.

At the time the work was started there were two recognized opinions as to the cause of distemper. One was that it is due to a germ that could generally be found in the windpipe and other parts of affected dogs; the other that it is caused by what is known as a filterable virus—that is, an infecting agent so small that not only is it invisible with the most powerful microscope, but it will pass through a filter which is fine enough to hold back all visible bacteria. The first thing, then, was to find out which of these views was the correct one; and the work that was done showed, beyond any reasonable doubt, that distemper is in fact due to a filter-passing virus, and not to the germ found in the windpipe, &c.

A fact which came to light early in the work, and which is of the greatest importance to the spread of the disease among sporting dogs,

was that ferrets are also liable to distemper, and the disease can be, and frequently is, transmitted from dog to ferret and from ferret to dog. That this was so had been suspected for some time, and once it was verified the investigators made use of ferrets for much of their experimental work, since a stock of ferrets is not only cheaper and easier to maintain, but they can be kept healthy in much closer quarters than dogs, and therefore can be guarded from chance infection more easily.

To give the details of the work carried out would be a very lengthy business and perhaps not very interesting to the layman, so I will make the account as brief as possible. Working with ferrets it was found that the virus or infecting agent was present in the greatest amount in the spleen of affected animals in the early stage of the disease, which is accompanied by high fever. Now, it is a well-known fact that once a dog has had distemper and recovered he is immune from further attacks for a very long time, if not for life; and once it was definitely known where the virus was to be found, and that by giving a dog or ferret a dose of it an attack of the disease could be produced, the crux of the investigation was reached. That is, it now became a straight-out question as to whether or not it was possible to give an animal a dose of virus which, while too small to cause disease, was nevertheless enough to produce immunity, or whether by using virus which had been killed by some artificial means the same effect could be produced. Although it has not taken long to give you this brief account of their work, the actual time taken by Dunkin and Laidlaw to reach this stage was about three years, and one can imagine what great disappointment would have been theirs had they found after so much carefully conducted work that artificial immunization could not be done.

A method of artificial immunization was tried out in the first place on ferrets, and in the investigators' hands was about 90 per cent. efficient. Now, as there is a considerably higher death-rate from distemper among ferrets than there is among dogs, it would be reasonable to suppose that if the vaccine used could be modified so as to be suitable for dogs it would be even more than 90 per cent. efficient in their case, and from experiments on dogs that have since been carried out it appears that this may very soon be an established fact.

The preparation of the vaccine is as yet in the rough, as it were, but the path to complete success has been pretty clearly indicated through the work already done. An endeavour is now being made to initiate similar work at the Wallaceville Veterinary Laboratory, so that here in New Zealand we may be in a position to test the methods that Dunkin and Laidlaw have discovered, and as soon as possible to place our dog-owners in the happy position of being able to immunize their dogs against distemper with confidence and certainty. It promises very strongly to become one of the greatest advances in veterinary science for some years, and the veterinary profession and dog-lovers all over the world owe their sincere appreciation not only to Dunkin and Laidlaw, whose brains and work have placed the matter on such a substantial footing, but also to *The Field*, which has raised the large sum of money that was required before the investigation could be properly carried out.

I would like to point out that there are many different diseases, both of man and animals, that are due, like distemper, to filterable

viruses, and since very little indeed has so far been found out about them, owing to the great difficulty of studying such things, this detailed and laborious work on the virus which causes distemper in dogs will probably have far-reaching results on our knowledge of the other diseases, such as foot-and-mouth disease of animals and infantile paralysis of human beings, which are due to infecting agents of the same class. Consequently the medical as well as the veterinary profession, and through them the public, are likely to benefit in many matters which to the layman appear very far removed from distemper.

PRACTICAL HINTS ON TREATMENT.

A few hints on the ordinary treatment of distemper may be given in the meanwhile. The disease attacks dogs generally in the first year of life; sometimes later, but seldom after two years old. After an incubation period of about ten days there is dullness and generally running at the eyes and nose. For the first day or two there is fairly high fever, after which the temperature generally falls and the dog appears much better, and the owner is very much inclined to think he is all right again and not bother any more about it. This is just where much of the trouble crops up, because in spite of appearances the dog is not over the attack by any means at that stage. The temperature rises again—not so high as at first, but quite enough to predispose the dog to pneumonia and other complications if he is not taken care of. This second rise of temperature lasts for two or three weeks, and great care must be taken of the patient until it finally falls to normal and remains there.

Aspirin in 5- or 10-grain doses once or twice a day, according to the severity of the attack and the size of the dog, is about the best drug for pulling down the temperature. The dog should be kept warm and comfortable, and exercise or any sort of work or excitement must be avoided. Under these circumstances constipation is apt to occur, and a small daily dose of medicinal paraffin is excellent to ward this off. As to diet, the best is the dog's natural food—raw meat; but he should not be *suddenly* changed on to this sort of food if he has been accustomed to other things. If diarrhoea occurs, as it is very apt to do in this disease, boiled milk, arrowroot, &c., are more desirable. About the best tonic to give is cod-liver oil, which is readily taken with the other food, so that, besides its undoubted value, it is no trouble, and the dog is not worried by constantly being given medicine.

A very important thing to remember is that distemper is *extremely* contagious. That point has been left till last in order to impress it more strongly. A dog with distemper that is allowed to roam about or is taken out for walks, will very soon infect all the dogs about the place that have not already had it. So for the sake of neighbours, as well as in your own dog's interest, if he shows any signs of the disease shut him up by himself. Do not handle him more than is necessary, and when you must do so wash thoroughly after it, as infection is only too easily carried on the hands and clothes. Do not let the dog mix with other dogs till he has been normal for several days, and when the trouble is over disinfect the place he has been in and burn his bedding.

Good nursing will do a great deal for any case of distemper, but where veterinary aid is available it should be sought, as there is perhaps no other disease in which so many different complications requiring special treatment may crop up.

Let us hope that before very long, as a result of the research work that is being conducted, distemper will become a thing of the past.

NOTE.—Since this lecturette was broadcast cabled messages from Britain have been published in the newspapers indicating that results have largely borne out the promise which the experimental work of Dunkin and Laidlaw held out. The Department of Agriculture has cabled for the fullest available information.

PREVENTION AND TREATMENT OF MAMMITIS IN DAIRY COWS.

Live-stock Division.

CONTAGIOUS mammitis causes much loss to dairy-farmers every season, and in order to minimize it as much as possible it is necessary that the greatest care be exercised in observing all precautionary and preventive measures, and also in applying proper treatment when cases have arisen.

It must always be kept in mind that the udder of the cow is made up of extremely delicate tissues, and, especially when in full milk, is extremely sensitive to any deleterious influences to which it may be subjected. When a cow is living under natural conditions, suckling her own calf, the milk is drawn by the calf in moderate quantities at frequent intervals, and the udder is not subjected to the process of alternate distension and complete emptying-out which occur immediately before and at the end of each milking under necessary dairy-farm conditions, and which in themselves increase its sensitiveness and its liability to trouble when subjected or exposed to any injurious influences. Among such influences may be enumerated the following :—

- (1) Direct infection by the streptococcus of contagious mammitis.
- (2) Temporary ill-health of the animal due to digestive or other trouble.
- (3) Improper operation of the milking-machine, such as running it at too high pressure, leaving on after the udder has been milked out, uncleanliness, &c.
- (4) Severe chills, which may be incurred in various ways, as, for instance, washing the udder with cold water on a cold day and not drying it immediately with gentle friction; contact of a portion of the udder, when large and pendulous, with cold wet ground, or with a frosted ground surface, when the animal is lying down.
- (5) Temporary overstocking of the udder.
- (6) Uncleanly conditions in and about milking-shed and yards.
- (7) Allowing dogs to hurry cows to the milking-shed.

Dairy-farmers should use every effort to prevent their cows being subjected to any of these influences. They cannot, of course, help weather conditions, and temporary ill health may occur in spite of the

best attention, but by the exercise of all possible care in the handling of the cows, in the use of milking-machines, and in the maintenance of cleanliness, many cases can be avoided.

PREVENTION.

Much time and much scientific effort have been devoted to the endeavour to find a thoroughly reliable preventive treatment for mammitis in the form of a vaccine or a serum, and if such a preparation could be found it would be a great boon to dairy-farmers. But so far no vaccine has been discovered which can be relied upon as being effective. Vaccine treatment has been given an extensive trial in New Zealand, but it has failed to give the results which had been claimed for it. This is in accordance with the experience of scientists dealing with both human and animal disease, who have found that, as regards diseases associated with infection of the type found in mammitis, vaccine treatment has not proved reliable, though endeavours to produce reliable vaccines have been in progress in all civilized countries for several years past. Nevertheless, research in this direction is still in progress, not only abroad but in New Zealand also.

It must be realized, therefore, that the utmost importance is attached to all possible precautionary measures which can be carried out by the farmer himself. These may be briefly summarized as follows :—

(1) Practise rigid cleanliness in all things. Pay particular attention to milking-machines and teat-cups. Keep leg-ropes as clean as possible.

(2) See that the machines are running at the proper pressure and not too high ; that they are not left on too long ; and that all parts are kept thoroughly clean.

(3) Every cow affected with mammitis must be regarded as a possible centre from which infection may be spread to other cows in the herd. Therefore, any cow known or suspected to have anything wrong with its udder must be kept back until all the others have been milked, and then be milked carefully by hand, the milker's hands being well disinfected immediately after handling of the cow has ceased.

(4) Never strip an affected quarter on to the ground—always into a receptacle containing disinfectant.

(5) The early detection of mammitis cases is of the utmost importance, both from the preventive and curative points of view. This is best done by taking a strip or two of the fore milk from each quarter before putting the machines on. Take these strips into a bucket the top of which is covered with fine wire gauze. Any small clots in the fore milk are then immediately detected, and a cow whose milk contains them must be regarded as a case of mammitis and treated accordingly.

(6) When a cow has apparently recovered from an attack, do not at once put the machines on her. Continue to milk by hand for two or three weeks, so that any possible remaining infection may not have an opportunity of being spread to other cows by the agency of the machine cups. In such cases it is a wise precaution to take samples of the milk from the quarters involved, send them to the Wallaceville Veterinary Laboratory for examination, and obtain a report before commencing the use of the machine.

TREATMENT.

When mammitis occurs, a great deal of benefit and a number of recoveries can be brought about by relatively simple methods of treatment, if *carefully* and properly carried out. They involve the expenditure of some time and trouble, but they are well worth adoption.

A good practice is at once to give the affected cow a dose of laxative medicine. A useful mixture to give is 10 oz. of Epsom salts, 2 drams of powdered nitre, and 2 drams of powdered caraway-seeds, administered in $1\frac{1}{4}$ pints of warm water or, preferably, very thin gruel. In severe cases, after the laxative effect of this drench has passed off, the cow can be given 4 oz. of Epsom salts dissolved in $\frac{1}{2}$ pint of warm water or thin warm gruel, once daily for three or four days.

Apart from this medicinal treatment, the following measures should be adopted :—

(1) Stripping : A most important feature of treatment is *frequent stripping*. This reduces the invading army of germs, and also removes the tissue-damaging substances which they produce ; moreover, by keeping the affected quarter as empty of milk as possible the germs will be deprived of much of their food-supply. Stripping should be done at frequent intervals—the oftener the better. Even if stripping could be done every two hours it would not be too often—in fact, it would be very advantageous.

(2) Massage : This should be done thoroughly but gently, from above downwards towards the teat. Do it after stripping. Olive-oil, or some simple harmless lubricant, must be used to prevent chafing the skin when massaging. It is a good plan to mix liquid extract of belladonna with the oil in the proportion of one part to four parts of oil. When this is done, again strip out the milk that massaging has brought into the milk-cistern.

(3) Fomentation : This is particularly helpful in severe cases, especially in the early stages. It is best done by applying a flannel wrung out in hot water, keeping the water hot throughout. Not less than half an hour should be spent in doing this. Afterwards rub in some olive-oil, preferably with one part of liquid extract of belladonna added to each four parts of oil. This will counteract the effects of cold after the fomentation (which is very important). In severe cases avoid turning the cow out if the weather is bad or there is no sheltered place to put her in. Foment thrice daily while the quarter is hot and swollen.

Iron Treatment for Bush Sickness.—In a recent report Mr C. M. Wright, Country Analyst under the mineral content of pastures investigation, relates a settler's experience as follows : " A farmer on the coastal pumice lands (Bay of Plenty) who is milking 130 cows on 200 acres was recently visited. He told me that his neighbours over the fence were farming on the same lines as himself, except that he put the iron-ammonium citrate as recommended in the drinking-water for his cows. He states that his cows average 8 lb. of butterfat per month more than his neighbours, and he is sure that the result is from the use of the citrate. He also feeds the drug in skim-milk to his calves, and now rears good ones, whereas before using it he had difficulty in doing so. One of the paddocks is on the reclaimed swamp, but the rest of the farm can only be a few feet above it.

NORTHERN WAIROA EXPERIMENTAL AND DEMONSTRATION FARM.

NOTES ON OPERATIONS IN 1927-28.*

THE season of 1927-28 commenced well throughout North Auckland with a mild and warm spring and plenty of growth. Towards the end of September, however, cold winds and squalls were experienced, followed by dry conditions, which continued, more particularly on the western coast, until well into the following March. The autumn recovery of the pastures was too late to be of real benefit to the milking-cows as regards yield.

PASTURES.

During the year further marked improvement has been shown in all the top-dressed pastures, which stood up remarkably well to the dry conditions until the beginning of February. The proportion of pasture in which paspalum is well established has been increased from practically nil to some 20 acres, and in the mixture for a further 12 acres of young pasture paspalum-seed has been included, though in the case of 6 acres sown in the autumn of 1927 very little paspalum is to be seen as yet. The fact that paspalum tends to increase under the conditions prevailing on the farm, where the rye-grass pastures open up during summer, is clearly shown by the gradual spread of the former grass through the older top-dressed and heavily grazed pastures where no paspalum-seed was originally sown, but was later introduced by stock.

The experience on the farm bears out the assertion that, by continuous top-dressing and good management, pastures which are predominantly rye-grass in the early spring and paspalum-white-clover-dominant during the summer can be maintained and are very desirable. The increase in the proportion of paspalum in the older purely rye-grass pastures is therefore looked on with favour, and steps will be taken as soon as possible, through the feeding-out of paspalum hay, to speed up the process with a view to establishing over the whole farm rye-grass, paspalum, and white clover pastures, with such grasses of the original sowings as timothy and meadow foxtail taking a minor part.

PASTURE TOP-DRESSING.

The funds available for top-dressing are directly dependent on the returns from the dairy herd, and it was hoped that the 1927-28 season would see an extension of experimental top-dressing, combined with further subdivision and the inauguration of an intensive rotational system of pasture grazing. Owing, however, to the prevalence of mammitis in the herd, and the lateness of calving of the majority of the cows due to the difficulty experienced in the previous season in getting them in calf, the top-dressing programme was necessarily restricted to a continuation of that of the previous year. An area of 66 acres was top-dressed at the rate of 3 cwt. of straight phosphate

* An article on the establishment and first two years' working of this subsidized farm was published in the *Journal* for January, 1928.

per acre, 33 acres receiving basic slag and a like area superphosphate. The chief point of interest in regard to the top-dressing results is the relatively greater improvement shown in the supered paddocks. In the first two years those paddocks top-dressed with 3 cwt. per acre of basic slag showed a much better response than those dressed with the same quantity of super. During the season under review the supered pastures showed up to advantage more in the growth of rye-grass, though the slagged paddocks are still preferred by the cows, due mainly to the better growth of white clover and generally shorter and thicker sward. The difference in the sward is particularly indicated by the persistence of pennyroyal and buttercup in the supered paddocks, whereas both these weeds have been almost completely crowded out by the better growth of white clover in those paddocks dressed with slag.

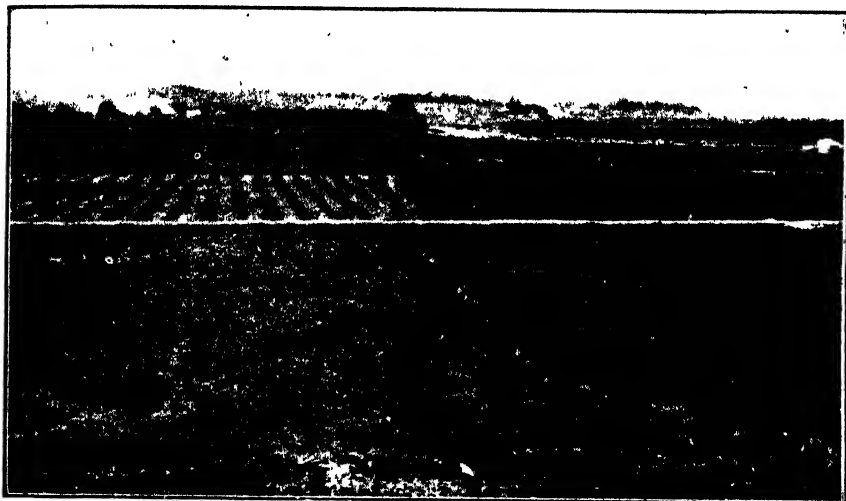


FIG. 1. PORTION OF THE IMPROVED PASTURES.
Tripod-harrowed area seen in middle distance

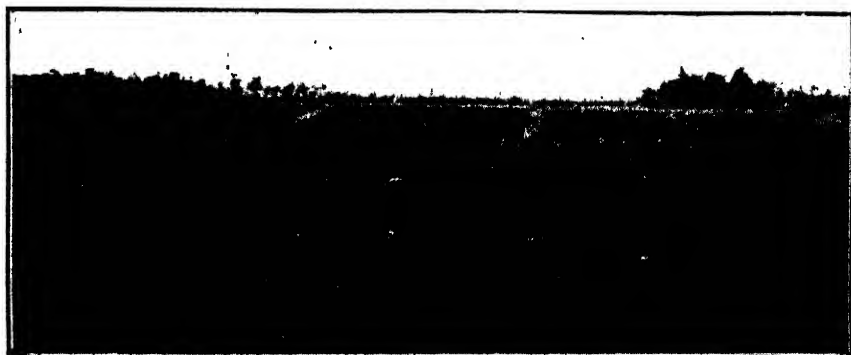


FIG. 2. PART OF UNDEVELOPED AREA OF THE FARM.

SUPPLEMENTARY CROPS.

Very definite periods of shortage in pasture-production are experienced on the farm in dry summers and during winter and early spring. The aim is to eventually provide for these periods by an increase in the proportion of paspalum and the conservation of excess spring and early summer pasture growth in the form of silage and hay. This provision is contingent on an extension of top-dressing (including special nitrogenous top-dressing), the introduction of more paspalum, better drainage, closer subdivision, and intensive rotational grazing on that portion of the farm already brought into fair pasture by the top-dressing already carried out. In the meantime crops such as soft turnips, swedes, and mangolds have been depended on to provide for the periods of shortage.

The entire failure of 4 acres of soft turnips and swedes after repeated sowings, owing to the sudden drying-out of the ground in October (1927), was reflected in the rapid decline in butterfat-production from January on. The mangolds, though standing up to the dry conditions better, also suffered from lack of sufficient moisture, and little growth was made by them until the autumn, resulting in a light crop, which, however, was very valuable for the early calvers. On land such as that represented by the farm the farmer is very dependent on weather conditions in growing root crops, unless extensive and costly underground drainage is carried out or he is fortunate in having a naturally well-drained paddock available. The failure of the crops referred to and the drying-out of the rye-grass pastures demonstrated once more the importance of paspalum and the necessity for conservation of the excess early summer growth, especially in the form of silage.

THE DAIRY HERD.

Though the pastures have been improved to a wonderful extent by top-dressing, tripod harrowing, and drainage, and the feed available definitely increased, the real stumbling-block in the progress of the farm has been the dairy herd. That the cows are capable of high butterfat-production is evidenced by the returns from those cows which have regularly come to profit early and have not suffered from mammitis. The average for the July and August calvers, which are representative of the rest of the herd, is well over 300 lb. of butterfat, whereas the average for the whole herd of twenty-six cows and sixteen heifers was just over 200 lb. in 220 days. A large proportion of the heifers necessary for replacements in the herd on account of disease were undoubtedly capable of much higher average production, but were more affected than the cows by late calving, followed by dry conditions. Despite the best efforts of the manager, together with the assistance of Live-stock Division officers, the trouble in regard to getting the cows in calf persisted, as also did the prevalence of mammitis, some twenty-five of the herd having suffered from this disease during the season under review. By the end of October only seventeen of a herd of forty-two cows and heifers were in milk, and the majority of the herd came to profit while the pastures were falling off under the dry conditions prevailing.

The value of top-dressing was demonstrated not so much by an increase in carrying-capacity, but rather by the fact that despite the

total failure of the soft turnips intended for use in January, February, and March, and the short milking season of the majority of the cows, together with the exceptionally dry summer, the production of butter-fat was some 400 lb. ahead of that of the preceding year, when there was good provision of soft turnips and a good summer rainfall.



FIG. 3. FIELD-DAY DEMONSTRATION OF PASTURE HARKOWS.

FUTURE WORK.

The future progress of the farm is of course dependent on production from the herd, and while this remains almost stationary, as it has done despite increased carrying-capacity during the past three seasons, this progress must be slow. The policy for the season of 1928-29 is a concentration on the lines already mentioned in the further development of the area so far brought into fairly good pasture. In this connection subdivision and rotational grazing will play an important part, and the effects of frequent tripod harrowing after each grazing will be noted. Provision has also been made for a definite reduction in the area under crops by an extension of hay-production and the introduction of ensilage-making.

—C. J. Hamblyn, B.Ag., Instructor in Agriculture, Whangarei

Loss of Lime or Plant-food from Soils.—"In New Zealand no data are available concerning the loss of lime or plant-food from different soils under various conditions of rainfall," states Mr T. Rigg in the course of a report on the Washington International Soil Congress. "In the past, agriculturalists have been apt to take the data obtained at such stations as the Rothamsted Station as applying directly to New Zealand conditions. The work of Professor Hendrick at Aberdeen, and of Professor Robinson in Wales, has shown that the loss of lime and phosphate from their soils differs widely from those of Hertfordshire soils. Similar data in connection with the loss of lime and plant-food from New Zealand soils are urgently required in order that liming and top-dressing of soils may be put on a satisfactory basis."



HON G. W. FORBES, M.P.,

MINISTER OF AGRICULTURE IN THE WARD MINISTRY.

Mr. Forbes is also Minister of Lands, and Minister in Charge of Land for Settlements, Scenery Preservation, Discharged Soldiers Settlement, and Valuation Department. The Ministry assumed office on 10th December, 1928.

CONTROL OF FIREBLIGHT IN THE ORCHARD.

HINTS TO FRUITGROWERS.

J. A. CAMPBELL, Director, Horticulture Division.

WHENEVER suitable opportunity has offered during the past two or three years fruitgrowers have been given to understand that fireblight would eventually have to be dealt with by the Department of Agriculture on practically the same lines as other diseases affecting orchards, but much more stringently, owing to the disastrous effects which neglect on the part of any fruitgrower might have with respect to the whole district concerned. There is a tendency to look to the Department to assume responsibility for the suppression of an outbreak, and in some measure blame its officers for any failure to suppress, whereas the blame could more equitably be laid on the careless orchardist. Individual effort on the part of growers is the keynote of control, and recent legislation enables them to apply co-operative effort more fully than was possible in the past. The course of procedure is briefly outlined in the matter which follows.

Each season in regard to fireblight may be deemed to commence with the blossoming period of fruit-trees, and any hold-over canker discovered at this time should be regarded as a canker from the previous season. While the cutting out of infections that occurred during the blossoming-period and later is highly desirable, and should be attended to as thoroughly as circumstances permit, the damage arising from such infections is largely confined to the particular orchard in which they exist.

The disease during this period is to a large extent spread by means of chewing-insects, which, although they may carry it to a nearby orchard, largely operate and spread the disease within the original orchard where it exists. This fact does not mean that reasonable work in cutting out infection should not be carried on. The right to insist on this work being done, within reason, cannot be foregone. Compulsion in extreme cases, in the form of prosecution, may be deferred till later, but orchardists must understand that the control of fireblight is their responsibility, while the Department's officers operate more as inspectors to ascertain how thoroughly the work is being done, and when the necessity arises to take action.

Apart from what may be insisted upon by the Department in the cutting-out and checking of the disease during the summer and early autumn, a definite date has been fixed after which the finding of hold-over cankers in an orchard would involve prosecution—namely, 31st July. By this date orchardists will have carried out the major portion of their pruning, which operation affords an excellent opportunity for the search and removal of cankers. It is physically impossible for our officers to make a personal inspection of every tree and practically every limb of every tree in their districts. The only hope of keeping a locality free of fireblight is that growers will make this individual tree-inspection and do the cutting-out of all classes of cankers. By means of general inspection visits by officers, and more particular

inspection where it is suspected that a grower has not been quite thorough, the efforts of the careful orchardists will be safeguarded.

The foregoing procedure in its entirety can, of course, only be applied to those districts in which hawthorn hedges have been removed or otherwise satisfactorily attended to. In localities where fireblight is present and no commercial fruitgrowing area has been declared by regulation the disease will be mainly dealt with as an ordinary orchard disease.

THE UTILIZATION OF WHEY.

ECONOMICS AND TECHNIQUE OF CONCENTRATION.

M. A. F. BARNETT, M.Sc., Ph.D., Physicist, Research Department, Wellington,
in the *New Zealand Journal of Science and Technology*.

IN England the problem of the utilization of whey became one of very great importance not so much because of any economic wastage, but because the disposal of the unwanted whey presents the greatest difficulty, due to the nuisance produced when it is discharged into sewers or streams, &c.

In New Zealand this latter aspect is not of such grave importance, but from the economic point of view an investigation is obviously warranted which might lead to a profitable utilization of the enormous quantities of whey at present going to waste. Based on the production figures for cheese, the total annual output of whey in New Zealand is about 600,000 tons, and of this quantity about 42 per cent. is produced in the Taranaki District, 16 per cent. in Wellington, 15½ per cent. in Southland, and 14 per cent. in the Auckland Province. If, for illustration, we assume that this whey is worth a farthing per gallon, the value of the annual output for New Zealand is about £140,000.

A certain proportion of the whey produced is already used for feeding direct to pigs, but there are some important drawbacks to this practice. In the first place, whey is so dilute—containing about 94 per cent. of water—that pigs would have to consume impossible quantities in order to assimilate an appreciable amount of solids; and, secondly, if whey is kept for any length of time in the dilute form it develops an increased acidity, which gives it a strong laxative action, rendering it of still less value as a pig-food.

On the other hand, if the whey is first concentrated by evaporating off a considerable amount of the water, both these troubles are overcome. The percentage of solids being much higher (say, 60 per cent. solids in the concentrated form), the pigs are able to assimilate more readily an appreciable amount; and, secondly, it is found that the concentrated product will keep indefinitely without developing any further acidity. Any concentration accompanied by better keeping-qualities will enable the whey to be stored readily, to be available for feeding over a longer period of the year, and transported at less cost.

A typical analysis is here given showing the composition of whey after the bulk of the fat has been separated for the manufacture of ~~whey~~ butter: Water, 94.70 per cent.; fat, 0.06; lactose, 3.51; protein, 0.78; ash, 0.51; lactic acid, 0.44; total solids, 5.30. It will be

seen that of the solids about 70 per cent. is lactose. The price paid for purified lactose makes its extraction from whey a profitable undertaking, but unfortunately there is only a very restricted demand for this article. The total annual consumption of milk-sugar for the whole of England is only about 400 tons, and this demand is already fully met.

When it is considered that the whey produced per year in New Zealand contains a total of about 20,000 tons of lactose, it is obvious at once that its extraction on a large scale is not feasible unless there is a complete revolution in the demand for this product. Precisely similar reasoning applies to the wholesale extraction of albumen, even if this were an economic possibility. One sugar-of-milk factory already in existence in New Zealand can supply all the requirements of this country, together with the demand from available markets outside. It would seem, therefore, that the only outlet for the utilization of whey on a large scale at the present time lies in the production of a concentrated product, from which a large percentage of the water has been removed, which would be suitable and find a market as a stock-food, more particularly for feeding pigs. Experiments are at present in progress along these lines.

The problem of the utilization of whey in England has been investigated by Dr. Harding, who did some preliminary work in 1922 for the Royal Agricultural Society of England. Later he carried out some large-scale experiments for the Ministry of Agriculture. The results of this work are published in Research Monograph No. 5 of the Ministry of Agriculture, "The Whey Problem and a Solution," by Leonard Harding, Ph.D. The paper describes the method adopted for condensing the whey at the cheese-factory, and deals fairly fully with the subsequent extraction and refining of the milk-sugar. The production of whey foods is dealt with briefly, and useful details are given of the costing of the various processes, and of steam requirements, &c.

In Harding's experiments an evaporator was set up at the Whitchurch branch of the United Dairies, Ltd., and the sugar-extraction was carried out at a factory at Haslington, some distance away. The whey condensed at Whitchurch was conveyed to Haslington in specially made 20-gallon churns. This arrangement was made to demonstrate the possibility of individual cheese-factories concentrating their whey before sending it to a central factory for sugar-extraction and stock-food production.

A specially-designed double-effect evaporator, utilizing a dry pump and barometric condenser, was employed at Whitchurch. The evaporator was capable of handling 2,000 gallons per day of eight hours, and it was worked so that the temperature in the first effect did not exceed 70° C., in order to avoid coagulation of albumen. The whey was condensed till it occupied less than one-tenth of its original volume, 100 gallons of the liquid being reduced to 8.75 gallons of the concentrate, which then weighed 110.8 lb. The concentrate is in the form of viscous liquid, and can be poured into cans for transport.

Tests on the evaporating plant showed a total steam-consumption (including steam for water-pump) of 5.85 lb. per pound of condensed whey produced. With an efficiency of 7 lb. of steam per pound of coal this means slightly less than 1 lb. of coal per pound of condensed whey.

Water was required for the condenser at the rate of 6,000 gallons per hour. At Whitchurch this water was drawn from one end of a comparatively stagnant brook and returned at the far end, the water being kept sweet by the addition of about $\frac{1}{4}$ lb. of chlorine daily. One man was able to look after the whole plant.

Taking the Whitchurch figures, and with coal at £1 5s. per ton, the cost of coal is about £1 2s. 6d. per ton of condensed whey. For labour, one man (at £3 per week) produced 12,000 lb. of condensed whey per week. This works out at £1 14s. per ton of the concentrated product. (60 per cent. solids) for steam and labour on the evaporator. To this must be added interest on the plant (cost about £2,200) and depreciation, &c. Also, there is additional labour involved in the extra boiler-stoking required, and in some cases a larger boiler might have to be installed.

Harding's method of extracting the sugar is described in detail in the pamphlet. Whey foods were produced from the residue after removal of the greater part of the sugar, thus giving a higher protein/carbohydrate ratio to the food than is obtained with direct concentration without any sugar-extraction. In one case the liquor was dried when mixed with a suitable drying agent in the nature of a foodstuff—*e.g.*, bran, sharps, or grains, &c.; in the other it was simply concentrated by evaporation to a semisolid mass and sold in barrels. In either case it sold at about £12 per ton; but the latter was the more popular, although still containing about 34 per cent. of water. Both proved valuable as a pig-food.

In conclusion to the pamphlet, Harding says, "It is submitted that the work described in this report has demonstrated that—(1) Whey can be condensed to less than one-tenth of its bulk in an economic manner, without interfering with subsequent extraction processes; (2) condensed whey will keep indefinitely and can be easily transported in suitable packages; (3) given a sufficient quantity of raw material at a central factory, milk-sugar and animal-foods can be economically produced from condensed whey."

In New Zealand an investigation is being carried out by the Department of Scientific and Industrial Research to test the economic possibilities of using concentrated whey as a pig-food. Practical tests on the concentration of whey were made at the sugar-of-milk factory at Edendale, using the existing plant, which consists of an American double-effect evaporator made by Swenson. This evaporator is a very simple type, in which the heating steam passes through a series of pipes immersed in the whey. This kind is much easier to keep clean than the type used by Harding, in which the whey boils inside the tubes, which consequently require frequent cleaning.

Tests have been made working the evaporator at 15 in. vacuum in the first effect and 25 in. in the second. There is slight trouble due to frothing, but this can be overcome by the addition of a small quantity of cotton-seed oil (or other cheap vegetable oil). The temperature in the first effect (80° C. for 15 in. vacuum) is probably sufficient to coagulate the albumen, although no trouble from that source is apparent. The plant is probably capable of dealing with about 1,000 gallons of whey per hour, which would mean an output per eight-hour day of $\frac{3}{4}$ tons (or more) of condensed whey produced from 6,000 gallons of

whely. Two thousand gallons of whey is condensed to a volume of 200 gallons, which weighs about a ton and contains approximately 60 per cent. of solids.

The tests indicate that not more than $1\frac{1}{2}$ tons of coal is required for all purposes per ton of whey paste produced, and this figure could probably be reduced. For labour on an evaporator of this size (3 tons output per day) one full-time man together with an extra boiler hand would be required, with possibly occasional assistance. As to capital cost, £3,000 is an estimate of the total installed cost of an evaporator of the type at Edendale. On the assumption that the existing cheese-factory boiler can supply the steam required, which is probably not justified (see below), a rough estimate of the cost of production of 3 tons of whey paste would be as follows: $4\frac{1}{2}$ tons coal at £1 10s., say, £6 15s.; labour—two men, per day, £2; interest and depreciation per day (200 days per year), £1 15s.: total, £10 10s.

This is about £3 10s. per ton according to cost of coal, and no allowance has been made for any payment for the whey (2,000 gallons needed per ton of paste would cost £2 at $\frac{1}{4}$ l. per gallon), or for barrels or other receptacles, &c. Also, the following figures indicate that additional boiler-capacity would be required at many factories. Take as a typical example a cheese-factory with an annual output of 400 tons making during the flush season 2 tons of cheese per day and utilizing a 20 h.p. boiler: Two tons of cheese per day would mean a production of about 4,500 lb. of whey per hour for eight hours each day. For concentration in a double-effect evaporator this would require approximately 3,000 lb. of steam per hour (over the eight hours), which represents the full output from a boiler of about 86 h.p. capacity. For the examples quoted, therefore, the existing 20 h.p. boiler would be quite inadequate. For smaller factories and periods other than the flush season there would be much less divergence between the steam required and that available from the existing boiler.

Analyses have been made of the whey paste produced at Edendale, and the following is typical: Water, 49 per cent.; protein, 6; ash (mineral), 4.7; acidity (as lactic acid), 1.2; fat, 0.3; sugar (by difference), 38.8.

Several tons of the paste have been prepared and distributed for trials of the feeding-properties for pig-raising at Lincoln, Weraroa, Palmerston North, and Ruakura. Its food value is also being tested by Dr. Malcolm at Otago University.

[NOTE.—Reports on certain of these trials will be published in a subsequent issue of the *Journal of Agriculture*—Ed.]

Improvement of Second-growth Country.—The annual report of the Fields Division for 1927-28 states: "The Lands Department is now conducting a demonstration farm in Whangamomona County under the provisions of the Deteriorated Lands Act. This farm is being run on economical lines, but, with the work that is being put in to it on good-management methods, considerable improvement both as regards carrying-capacity and appearance is already being shown. The instructional officers of the Fields Division continue to co-operate with the officers of the Lands Department in the work necessitated in connection with advances under the Deteriorated Lands Act, particularly in the King-country."

THE CLIMATE OF NEW ZEALAND.

E. KILSON, M.A., D.Sc., Director of Meteorological Services, in the "New Zealand Official Year-book, 1929."

THE problem of the classification of the climate of a country may be regarded from various aspects. First of all, there is its solar climate, which depends on the amount of heat it receives from the sun and the variations of this amount with the seasons, and which is determined solely by the latitude of the country. New Zealand lies wholly within the Temperate Zone, and on the equatorial, or warmer, side of it. The amount of heat received from the sun is therefore never excessive even in the far north, while even in the middle of winter and in the southernmost portions, on the other hand, the sun rises high enough to give considerable warmth during the day. The difference in length between the longest and the shortest days in the year is about four and two-thirds hours in the northernmost and seven and one-third hours in the southernmost extremity of the Dominion. The day has never so short a length as eight hours.

If the surface of the globe were homogenous—if, for instance, it were all ocean—all places on the same parallel would have the same climate, and there would be no need for any other classification than according to solar climate. Instead of this, however, we have a varying surface, some of it being land and some water, while the land surface varies in nature and in elevation. Solar radiation has very varying effects on these different types of surface, and these in turn react in different ways on the atmosphere. Based on these physical conditions, then, we have two main types of climate—viz., continental and marine. A marine climate is controlled to a large extent by the waters of the surrounding ocean areas, and, since New Zealand nowhere has any great breadth, its climate is of the marine type. The distinctive feature of such a climate is its sluggishness as regards temperature changes when compared with a continental one. When sunshine falls on a land surface most of it is absorbed in a very shallow layer and converted into heat. The surface, therefore, tends to become very hot. Water, on the other hand, reflects a large portion of the sun's heat back through the atmosphere, whence it is lost. Such radiation as is absorbed penetrates to a considerable depth, so that the rise of temperature at the surface is slight. Even then a good deal of the heat thus accumulated is expended in evaporating water. Over the ocean, therefore, there is very little difference in temperature between the coldest part of the day, just before sunrise, and the hottest, in the early afternoon. Over the land the difference is considerable, and increases, generally speaking, with the distance from the shore. Similarly, in a marine climate the difference between summer and winter is relatively small. Another effect of the sluggishness in temperature changes is that the seasons lag behind the movement of the sun. The spring is cold, although the days are getting longer and the sun higher and stronger. It is common knowledge in New Zealand that we are liable to cold snaps practically up to Christmas. Frosts damaging to vegetation are not rare in November, and snowstorms occasionally affect comparatively low-lying

country even later in the year. On the other hand, the autumn is warm. In New Zealand mild temperatures may be experienced well into April. A marine climate is generally characterized by high average rainfall, its atmosphere being abundantly charged with moisture evaporated from the sea.

Generally speaking, then, the climate of New Zealand is equable, with an abundant precipitation, which is spread fairly uniformly over the different months. Not only is this so, but the difference in climate between the northern and southern extremities is comparatively slight in view of the fact that the Dominion covers a range of nearly 13 degrees, or about 900 miles, in latitude. The mean temperature at sea-level falls from about 62° F. in the far north to about 50° F. in the far south.

Another aspect from which there is an increasing tendency for geographers and meteorologists to classify climates is that of the vegetation produced by the soil. There are many plants which are able to live only within certain definite climatic limits, and others require certain restricted conditions to produce satisfactory growth. Since man depends so much for his livelihood on the products of the soil, the classification of climates on this basis is a logical and very useful one. From this point of view New Zealand has a warm-temperate and humid climate. The rainfall is almost everywhere sufficient for plant requirements all the year round. The temperature of 50° F. is an important one from the biological point of view, since many plants of the temperate region do not grow well unless the air rises above this temperature for considerable periods. Nowhere in New Zealand are there more than five months with a temperature lower than 50° F. In the Auckland Peninsula and coastal places a little farther south, mean temperatures do not fall below 50° F. in any month. As regards the settled portions of the Dominion, it is only in the elevated regions of Otago and Southland that the mean temperature falls slightly below 40° F. in some of the coldest months, or that the mean minimum for any month falls below freezing-point; consequently the ground is nowhere continuously frozen for long periods. Owing to these mild temperatures, there is some growth of herbage practically the whole year round. Vegetation has no long period of rest, and deciduous trees are practically unknown.

Since temperatures are everywhere warm enough to promote growth and nowhere excessively hot (the mean maximum for any month probably nowhere reaches as high as 80° F. or the mean temperature as high as 70° F.), there is comparatively little difference between the North and South as regards the nature of the things grown. Grapes, for instance, can be grown successfully out-of-doors in parts of all provinces of the Dominion. Certainly, in the North such semitropical products as citrus fruits can be grown successfully, whereas in the South this is not possible.

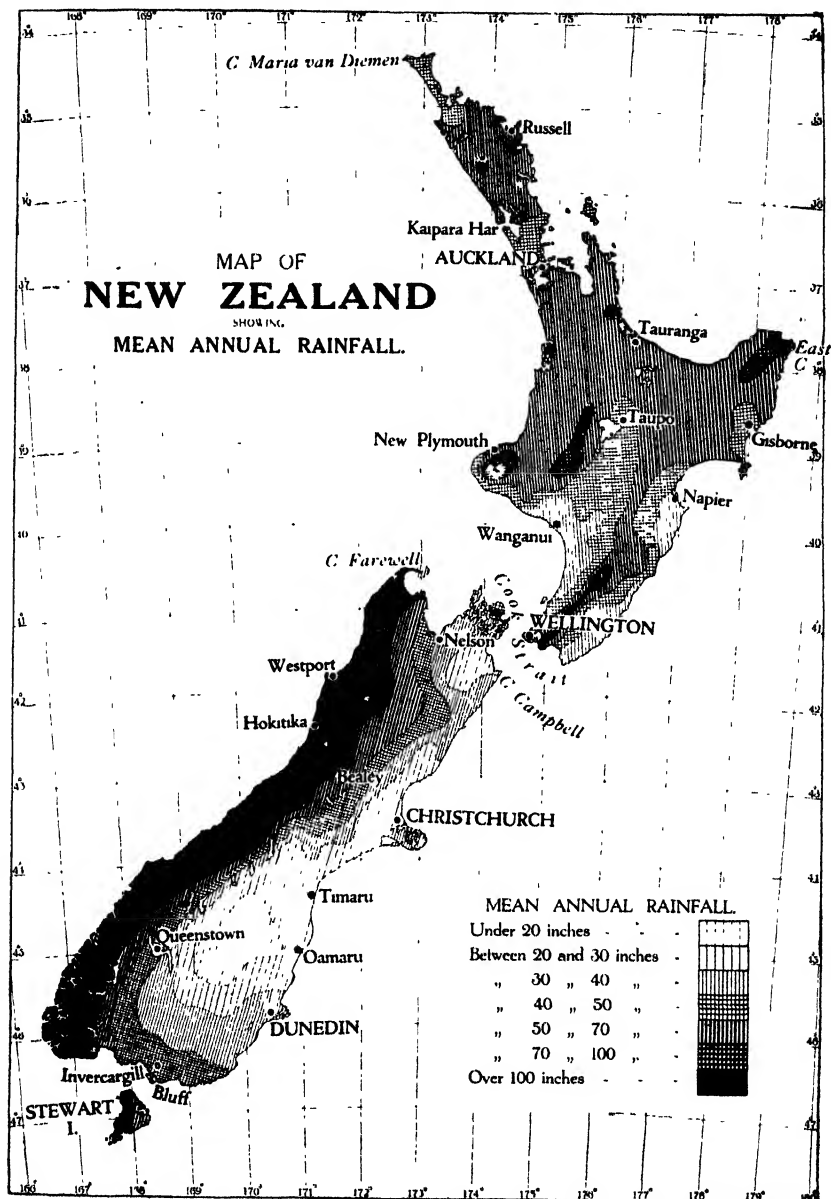
As regards human occupation, New Zealand lies in the zone of the Southern Hemisphere which is subject at all times of year to frequent moving barometric depressions, with all their accompanying weather-changes. Some experts consider this an important condition for the development of civilization in its highest form. Cloudiness is nowhere excessive, so that there is plenty of sunshine, and a considerable range

between day and night temperatures, which again tends to produce bracing conditions. Indeed, there can be few countries so admirably adapted for the production of a high yield from the soil and the maintenance of a high standard of comfort and civilization as New Zealand.

The Dominion is in the region of prevailing westerly winds. North of about New Plymouth and Napier these westerlies are not, in the main, strong, and, in fact, in summer there is a prevalence of south-easterlies. Though these can scarcely be classed as trade-winds, even in the far North, they are to a large extent part of the same system. South from the 39th parallel of latitude the westerlies prevail, and although in the free air, at least, their mean strength increases the farther south we go, they are of considerable average force even in Taranaki and Hawke's Bay.

We next have to consider the feature that exercises the most potent influence in modifying climate in New Zealand--that is, its mountain-ranges. Such variations of climate as are encountered in the different parts of the Dominion are produced mainly by these ranges. Their effect is closely associated with the prevalence of westerly winds. A range of mountains presents an obstacle to a wind which meets it. To force the air up and over it requires a great deal of energy. Wherever possible the wind will flow round rather than over. The most notable instances of this effect in New Zealand are found in the Cook and Foveaux Straits regions. Air in a westerly wind is forced round and over the lower portions of the northern part of the South Island into Cook Strait. Some of the air thus entering the strait possibly comes from as far south as Westport when the general wind is from due west. At the same time, the ranges in the North Island deflect into a southerly direction all winds which strike south of Cape Egmont. Some of the air is forced through the comparatively low gap in the neighbourhood of the Manawatu Gorge, while the greater part goes on down to Cook Strait. Similarly, in the south-west corner of the Dominion, a westerly wind is deflected into a south-westerly and flows round Puysegur Point into Foveaux Strait. A south-westerly wind is deflected into a westerly through the strait. The two regions mentioned are ones through which winds from a considerable area are forced to converge, and the consequence is that they are subject to an unusual proportion of strong winds. Through such channels it is practically only possible for winds to have one or two directions--*i.e.*, they must blow through the straits from one direction or the other. Owing to the great preponderance of winds from a westerly quarter, the prevailing direction in Cook Strait is from the north-west. This wind may correspond with any direction between north-west and south-west in the open ocean waters where winds are unimpeded. More rarely there are strong winds from an easterly direction, which produce south-easterlies in the strait. These may correspond with any wind between north-east and south over the open waters to the east. In the South the predominance of westerlies is greater than at Wellington, but there are at times strong easterlies through Foveaux Strait. Though not on the same scale, effects of a similar kind are noticeable in other parts. Round East Cape, for instance, there is a tendency for winds to be deflected along the coastline, and easterly winds are likely to be specially strong there. At Nelson there is a different effect, and westerly winds tend to be deflected

down Tasman Bay as south-westerlies, but at the head of the bay meet the winds which have come round Cape Farewell and are checked. If the general wind, therefore, is between north-west and west-south-west about, the winds are usually light at Nelson.



When the general wind is almost due south-west, or practically parallel to the main range in both Islands, many parts of the Dominion are protected. Strong south-westerly winds may be blowing and wet weather prevail in the southern parts of Otago and Southland, and also in Taranaki and the northern parts of the Auckland Provincial District, while much of the rest of the country, including the inland portions of Otago, Canterbury, and Marlborough, the east coast of the North Island, and especially Cook Strait, experience unusually fine yet bracing weather and comparatively little wind. A slight deviation of this wind to one side or the other means bringing unsettled weather to the west coast of the South Island or to the eastern districts from East Cape southwards.

The checking of the westerly winds by the Southern Alps results in a large proportion of variable winds on the west coast of the South Island.

Although it is true that wind will flow round an obstacle in preference to climbing over it, yet when a broad belt of winds meets a mountain barrier lying across its path much of the air must be forced over the range. This happens when the prevailing winds, which are from between north-west and west, strike the Southern Alps, and, to a less extent, the ranges of the North Island. The distribution of rainfall over New Zealand is greatly influenced by this fact, as can be seen from the accompanying rainfall map. Most of our rain is produced from moisture carried from warmer latitudes by north-westerly winds. The rain falls either in the north-westerlies or when the latter are forced up by colder south-westerly winds. When the westerly or north-westerly winds are driven over the mountain-ranges they rise into regions in which the air-pressure is much reduced. They are, in consequence, cooled. The colder the air is, the less uncondensed water-vapour can it contain. Moisture is therefore condensed, and falls as rain on the mountain-tops and their western slopes. Generally speaking, therefore, districts with a westerly aspect have the heaviest rainfall. This is especially noticeable in the South Island, where the west coast opposite the Southern Alps has an excessive rainfall, while in their lee we have the driest areas in New Zealand, that in Central Otago being the most notable. Round Mount Egmont is another area of heavy precipitation. The East Cape district has a high rainfall because it gets a good deal of the north-westerly rain, and is also subject to very heavy falls in easterly winds which occur in connection with cyclones in the neighbourhood of the North Island.

When the westerly winds blow over the mountains they sometimes shoot down them again on the opposite side. Falling into levels where the pressure is higher, they are heated, just as the air compressed in a bicycle-pump is heated and warms the pump. Having lost a good deal of their moisture, they are very dry, and the energy gained by falling down the mountain-slopes adds to their speed. We therefore have the gusty, hot, dry wind which is characteristic of mountain regions and is called the "Föhn" wind. The Canterbury Plains, especially the portions near the foothills of the Alps, are one of the regions of the world where the Föhn effect is most notably developed. The characteristics of the north-west wind are well known to the dwellers in those parts. During the Föhn wind a band of clear sky is produced on the leeward

side of the mountains, while farther away cloud often forms again at a considerable height. This gives the characteristic appearance of the "Föhn arch." Though most strongly developed in Canterbury, Föhn winds are experienced also in Otago, parts of Marlborough, and from the Wairarapa to Hawke's Bay.

Föhn winds, owing to their high temperature and to the fact that relatively high pressure tends to be produced in them on the west side of the ranges and relatively low on the east side, are often underrun by east or north-east winds on the east coast. These are especially prevalent in Canterbury, and the north-easter is a persistent and humid wind of an unpleasant type.

The shelter given from the ocean-winds, and the clear dry atmosphere produced by the mountains, causes a nearer approach to continental conditions in their lee than in other parts of the country. The greatest extremes of temperatures are found in these regions.

In addition to the climatic effects above described, there are others produced by mountains and due directly to the elevation. Other things being equal, the amount of precipitation increases with elevation, until about 5,000 ft. or 6,000 ft is reached. Higher than that, it falls off again owing to the fact that the cold air above those levels is able to hold little moisture. Again, the greater the height above mean sea-level, the lower the mean temperature, the difference being about 3.5° F. per 1,000 ft. There are no closely settled areas in New Zealand sufficiently high for the elevation to produce any very marked influence on the climate. The effect is to some extent counterbalanced, too, in most places by the facts (1) that the sloping ground prevents the accumulation of cold air on the surface, so that night temperatures are less extreme than they might otherwise have been, and (2) that the atmosphere is more transparent, owing to the reduced amount of vapour it contains and the absence of dust, so that the sun seems to give more heat.

Above about 5,000 ft. snow frequently lies for long periods and the climate is severe. Forest-trees become more and more stunted as this height is approached, and finally are unable to survive. Beyond it we have a mountain climate and characteristically alpine flora. The latter is adapted for resistance to drought, although actually the rainfall is usually heavy. The adaptation is necessary because of the rapid drainage, the intense heat produced on still clear days by the sun's rays, and the cutting-off of water-supplies from the roots for long periods owing to the freezing of the ground. Even in these high regions, however, conditions are not extreme. It is probably very rarely indeed that the temperature falls as low as 0° F., except perhaps for short intervals and in sheltered basins. The mountain region of the Southern Alps is, nevertheless, of great interest on account of its large and characteristic glaciers. The Franz Josef Glacier is especially famous, owing to the fact that it descends almost to sea-level, although the latitude is comparatively low. No doubt the very heavy rainfall on the mountains in this district and the rapid fall to sea-level are chiefly responsible for this effect.

Tables giving average values of various meteorological quantities for a number of typical stations, and serving to indicate the variation of climate in the different parts of New Zealand, are appended to the article in the Year-book. For comparisons with New Zealand conditions, data are also given for Kew Observatory,

near London, and for Aberdeen. It is shown that even at Kew the mean temperature is lower than at Queenstown or Invercargill, while at Aberdeen the mean maximum is less than 2° F. higher than the mean temperature at these stations. Again, the number of days with rain is much higher at the British stations than in New Zealand for rainfall totals of corresponding amount. The Dominion also has a much larger average amount of bright sunshine.

A SIMPLE PUMPING METHOD FOR MILKING-SHED DRAINAGE.

J. W. SMITH, Dairy Instructor, Palmerston North.

AN efficient and profitable method for handling manure and drainage from a milking-shed where there is no natural fall consists in the use of a small sump, a manure-pump, and a square 400-gallon tank or other suitable receptacle placed on wheels. The cost of the outfit is small when one considers that the manure spread on the land is a valuable top-dressing, and that the farmer is at the same time getting rid of what is a source of nuisance at the dairy.

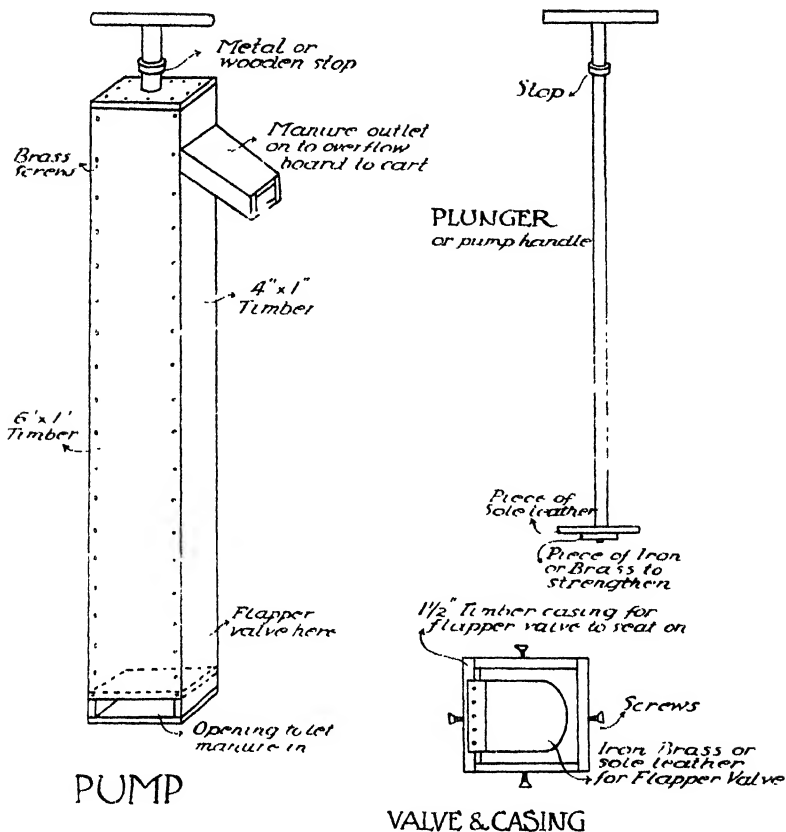
The requirements for this pump are two perfectly straight boards 6 in. by 1 in., and two boards 4 in. by 1 in., both of heart rimu timber; one straight pole (an oar for a row-boat cut down to a suitable length is recommended); 1s. 6d. worth of good heavy sole leather; two small oblong pieces of iron or brass; and a number of brass screws. The length of the boards and pole or plunger depends upon the height of the tank on the vehicle. The timber must be screwed together in the form of an oblong box by brass screws, and made airtight. An opening or overflow should be made about 4 in. from the top of the box, and an opening 1 in. from the bottom to let the manure into the pump.

A flapper-valve should be made separately and fitted into the bottom of the box about 1 in. up from the bottom, using 1 in. or 1½ in. timber as the casing for the flapper-valve to sit upon: This frame is attached to the box by means of four screws, so as to permit convenient handling should it be necessary at any time to adjust or renew the flapper-valve. Use one piece of iron with part of the sole leather for the flapper-valve, to ensure having sufficient weight for a perfect seating.

A piece of sole leather should be placed at one end of the straight pole, the underneath side being strengthened by the other piece of iron, or brass, while at the other end a piece of wood is firmly screwed crosswise to act as a handle. The plunger-rod is then complete.

Any blacksmith or carpenter can make a pump of this kind for about £2 or £3—possibly less. The advantage of having only the one flapper-valve in the pump is that it permits the inflow of thick drainage matter, and the plunger helps to break up any hard lumps or mud; moreover, by taking out four screws the valve can easily be renewed at any time.

The tank or container should be fitted with a 3 in. tap, and the drainage matter can be permitted to flow into a box at the tail of the cart, in which there are evenly spaced openings, while a chain harrow can be hooked on to the axle of the cart for raking the manure into the ground.



PUMP

VALVE & CASING

SKETCH OF THE MANURE OR DRAINAGE PUMP AND ITS PARTS.

If the farmer objects to the manual labour of pumping, he can fix up a counter-shaft and work this pump from the engine. The disposal of drainage from the milking-sheds at some of the farms in the writer's district is being successfully operated by this method. The accompanying sketch will give a good idea of the details of construction.

Soil Fertility and Plant Nutrition.—Reporting on the recent International Soil Congress, held at Washington, Mr. T. Rigg, New Zealand delegate, states: "One of the more important subjects discussed by the commission dealing with plant-nutrition problems was that connected with the intake by plants of food in the soil. Investigations of various workers conducted on acid soils have shown that the amounts of phosphate found in the soil-water bear little relationship to the amounts taken up by plants, or indeed added to the soil in manurial treatment. It now seems probable that the plant itself possesses special functions in the acquisition of the plant-foods contained in the soil. Some workers have suggested that the intimate relationship of soil-particles and root-hair must be viewed as a single system. In this system the root-hairs possess special facilities for attacking insoluble mineral plant-food. Other workers have suggested that the rate of evolution of carbon dioxide from the roots has an important bearing on the solution of mineral plant-food."

CASEOUS LYMPH-ADENITIS IN SHEEP.

PRECAUTIONS FOR SHEEP-FARMERS.

Live-stock Division.

THE condition known as caseous lymph-adenitis, found in sheep, is characterized by the enlargement of the lymphatic glands (commonly known as "kernels") of the body and the production in them of collections of a greenish-coloured pus, which, when the condition has been in existence for some time, becomes converted into a cheesy-looking material.

Lymph-adenitis is present in New Zealand to a limited extent, but it shows indications of spreading, hence it is specially necessary for sheep-farmers to take all known precautions to prevent it. In Australia, Argentina, and Uruguay it is evidently very widely distributed, and recently the British authorities imposed some restrictions upon imported mutton from these countries on account of this trouble. The presence of lymph-adenitis in the glands does not necessarily render the carcass unfit for human consumption, but it does depreciate its value from a trading viewpoint; hence the necessity for doing all that is practicably possible towards controlling and eradicating this trouble.

Lymph-adenitis may be found in lambs and hoggets, though aged ewes are most commonly affected. In lambs becoming infected a condition of pleurisy is sometimes set up. It occurs in all breeds of sheep, and it is a matter of economic importance that sheep-farmers should take precautions to prevent, as far as possible, the spread of infection.

There is very little evidence to show that the disease may be caused through ingestion of food or water contaminated with the organism which is the cause of the disease. As the trouble is more frequently located in the "kernels" situated at the upper regions of the limbs, this fact would suggest that the most common mode of entry of the organism is through accidental inoculation of wounds. That view is supported by work carried out at the Wallaceville Veterinary Laboratory, where more or less typical lesions have been set up by the experimental inoculation of skin wounds. Hence it is necessary that careful precautions be taken to prevent infection of wounds accidentally made during shearing and crutching.

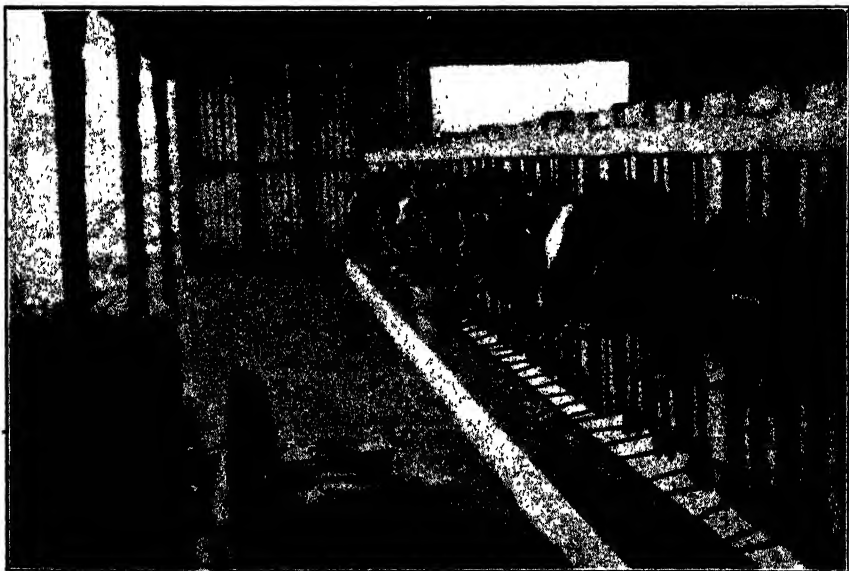
It is customary where hand shearing is practised to frequently dip the blades in a reliable antiseptic, and this should always be done. It is most important that all wounds should be at once dressed with some antiseptic preparation. If this precaution were carefully and efficiently observed in every case it would be of the greatest value in assisting towards preventing the setting-up of lymph-adenitis in the sheep which have sustained the wounds, and also in helping to prevent the spread of the disease generally.

It has not been absolutely proved that infection is present in the surface soil of yards and of their immediate surroundings, but

sufficient circumstantial evidence exists to warrant giving the advice that, wherever the trouble is known to be present among the sheep on any property, it will be a wise and desirable precautionary measure to either saturate the soil of the yards with a strong antiseptic solution—say, one part of non-poisonous dip to twenty parts of water—or, what is better still and more thorough, to remove the whole of the surface soil for a depth of at least 9 in. and replace it by fresh clean soil, such as could be obtained by excavating into a hillside.

In addition to the yards, there is a possibility that holding-paddocks nearby, which may frequently be used for temporarily accommodating large mobs of sheep, may be more or less contaminated. Where it can be conveniently done, it will be a good plan to plough up, cultivate, and resow such paddocks at intervals of a few years.

The dressing of all wounds seen at shearing-time is a very necessary precaution. This fact is brought to the notice of the Department from time to time when losses occur from blood-poisoning after shearing. Any extra labour involved is therefore worth the trouble by reducing the prevalence of lymph-adenitis and also as a preventive of blood-poisoning. That ewes are more commonly affected may be due to the fact that, owing to their longer life, they are more often exposed to infection of wounds liable to be caused during shearing and crutching.



CALF-FEEDING BAILS AT RUAKURA STATE FARM.

SEASONAL NOTES.

THE FARM.

CATCH-CROPS FOR GREEN FEED.

IN the more humid arable farming districts of Canterbury catch-crops of cereals are frequently sown on stubble land to provide autumn green feed. In these districts short rotation rye-grass pastures are commonly rotated with roots, rape, and cereals, and during the dry summer and autumn weather little or no feed is provided by these rye-grass pastures. The green cereal crops provide the necessary rich succulent feed to flush the breeding-ewes prior to their running with the rams, and to carry the ewes in good condition until the later autumn rains bring on the green pastures. Although the yield per acre from green cereals is not high the feed thrown is very nutritious, and the crop grows well under dry-soil conditions. The earlier the green feed is got in the better, so that the first sowing usually follows early-harvested autumn-sown oats. Algerian oats or Cape barley are the cereals usually sown for green feed, the latter being generally the most successful when the soil conditions are very dry. On light and medium land the green crop can be most cheaply established by broadcasting the seed on the stubble and covering with a one-way disk cultivator, or by skim-ploughing.

The seed-bed for green cereals is also frequently prepared by ploughing and working down in the ordinary way prior to drilling the crop. Although this method entails more time than the previously mentioned one, the work put into the land for the green cereal lightens the cultivation work necessary in the following spring prior to sowing the land in root or forage crops.

LUCERNE.

Young stands of lucerne sown about the end of November and in December should be ready for their first cut in February. Many promising stands are ruined by too early cutting in the first year. The first cut should not take place till the young plants are blooming and fresh buds have appeared at the base of the plant. Cutting before this stage is reached greatly weakens the vigour of the young plants. Most late spring-sown stands of lucerne will produce a strong second growth during the first season, but unless the crop is mature—*i.e.*, the crop is in bloom and fresh buds have appeared—before the late autumn the stand should not be cut, but the herbage left on the plants over the winter. The leaving of the herbage encourages a more vigorous root and leaf development the following season.

With old-established stands it is also advisable to leave a good cover of herbage on the plants over the winter. Many promising stands are injured by grazing the crop hard in the winter. Rye-grass, *Poa annua*, white clover, catsear, and rib-grass—all common weeds of lucerne—establish themselves where there is a short turf and plenty of light. Cutting in the late autumn and grazing during the winter when the lucerne is practically dormant thus expose the stand to weed invasion.

SOWING OF SECONDARY BURNS.

Should favourable weather conditions prevail during the next few weeks, settlers on surface-sown hill country will have the opportunity of cleaning up areas that have reverted to fern and second growth. On areas where the fern growth is not too thick and beneath which is a turf containing *danthonia*, *paspalum*, brown-top, or *Lotus major*, the pastures can be brought back with burning and regulated stocking. Land that has completely reverted must be burned and resown, and it is desirable to burn in the autumn rather than in the summer, and to sow the grass-seed as soon after the burn as possible. A good general mixture would be as follows: Perennial rye-grass, 6 lb.; crested dogstail, 4 lb.; brown-top, 2 lb.; white clover, 1 lb.; *Lotus major*, $\frac{1}{2}$ lb.; *Danthonia pilosa*, 3 lb.: total, 16 $\frac{1}{2}$ lb. per acre.

Perennial rye-grass establishes rapidly and throws a fair quantity of feed as long as a certain amount of ash remains round the plants. Crested dogstail establishes very well on secondary burns, and is very valuable in that it maintains a cover on the ground between the going-out of the rye-grass and the coming-in of the slower-establishing grasses, such as *Danthonia*, brown-top, and *paspalum*. Brown-top gives a cheap cover and a permanent sward, and 2 lb. of brown-top seed should be included in all mixtures for secondary burns. White clover provides a cheap and quick cover, and, where top-dressing can be practised, is likely to be permanent. New-Zealand-grown white-clover seed should always be sown in preference to imported white clover. *Lotus major* is rather slow to establish, but spreads rapidly after its third year. It is particularly valuable for sowing on weathered slips and patches of loose soil. *Danthonia pilosa*, although slow to establish, will ultimately give a permanent sward under hard surface-soil conditions, and should be included in all mixtures. *Paspalum* should be included in all mixtures on country where it is likely to succeed; unfortunately, the establishment of this grass is both slow and erratic. On the more accessible, better-class country the burn should be top-dressed immediately after seeding; on poor high country top-dressing is often impossible, and the aim should be to get such land into *danthonia*.

SUMMER SUPPLEMENTARY FEEDING OF DAIRY COWS.

The prolonged spell of dry weather experienced last summer has led this year to a great increase in the conservation of some of the surplus early summer production of grass, as ensilage for feeding dairy cows during the dry autumn weather. The making of grass ensilage should become just as much a matter of routine on dairy farms as the making of hay. Grass ensilage can be most easily conserved in pits or trenches, and it is really much easier to convert grass into ensilage when pits are used than to make it into hay. The great advantage of grass ensilage for summer supplementary feeding is that it can be saved in years of good rainfall and abundant grass-growth, and kept for dry years. A stack or pit of grass ensilage is the safest insurance policy a dairy-farmer can hold against drought.

Paspalum could well be more widely cultivated in the southern part of the Auckland Province as a summer feed than it is at present. The common idea that once *paspalum* is sown it will eventually spread all

over the farm, smother out all other grasses, and leave the farmer with no winter or early spring feed is quite wrong. Experience has shown that where regular top-dressing is carried out and proper pasture-management methods adopted, mixed pastures of rye-grass, cocksfoot, and paspalum can be maintained. Paspalum will not spread into an ordinary rye-grass, cocksfoot, and clover pasture as long as the pasture has a close sward. Paspalum usually establishes itself in a mixed pasture where the turf is opening up, and really occupies spaces that would otherwise be growing weeds. The best way to establish paspalum is to sow 5 lb. or 6 lb. of seed with the ordinary permanent pasture mixture used in the district; or the paspalum-seed may be sown with Japanese millet in the summer, and rye-grass and clovers later established by disking the millet stubble and broadcasting the grass mixture and manure.

—P. W. Smallfield, B.Ag., *Fields Superintendent, Auckland.*

THE ORCHARD.

FRUIT-EXPORT POINTS.

THE chief consideration of the commercial orchardist during the next two or three months will be the harvesting of the apple and pear crop, and the preparation for export of a good proportion. The work entailed is exacting, and numerous details must be closely watched. In order that efficient work may be done and labour costs reduced to a minimum, some time should be spent in making ready for the season beforehand. Firstly, it would be well for the exporter to study closely the grading regulations, and generally acquaint himself with all the requirements. Comfort and convenience in the packing-shed increase efficiency and decrease costs. Some rearrangement of the shed may therefore be advisable, with the idea of reducing confusion and extra handling of cases. Fruit coming in at one point, having been passed over the grader and packed, should be worked towards a loading-out point. Even the smallest shed may be so arranged as to minimize handling.

The actual work of grading is made light or heavy according to the quality of the fruit and the way in which it has been picked. This is a matter which the orchardist may largely regulate himself. Firstly, in the producing of the crop, for the success of his season's operations thus far is largely reflected in the quality of fruit coming on to the grading-table. Good fruit is easily and inexpensively graded, and may be expected from an orchard where the trees are in good heart, diseases have been controlled, and the crop has been sufficiently thinned and blemished fruits removed in the process. Secondly, all possible assistance should be rendered to the packing-shed staff, the graders in particular, by selecting during picking operations only those fruits which are up to the standard for export. Pickers should be made acquainted with grading regulations, and thus avoid picking fruit not up to standard. All obvious rejects should be discarded during picking, in order to lessen the number of rejects finding their way into the packing-shed.

The need for care in picking and handling cannot be too often emphasized. Fruit must be picked with stalk intact. Picking-bags should not be overfilled, nor should picking-boxes be made too full. Fruit should be taken in the palm of the hand and lifted, not pulled. The latter method often damages fruit-spurs and wrenches the stalk from the fruit. Picking of fruit at the right stage of maturity is most important. Immaturity is a particular evil which should be avoided. Several picks should be made, the first usually being moderately light, when the fruit should have taken on a perceptible change in ground-colour.

In the actual packing care must be exercised to develop a good pack. Excessive bulge is deprecated, but a medium bulge with no looseness at the sides of the cases will ensure good carriage.

SPRAYING.

Although the main spraying operations may have been completed by this time, some consideration must still be given to the matter of control of diseases and pests. Damage by codlin-moth and leaf-roller caterpillars must be prevented, and attention still be given to the later varieties. Late infections of black-spot sometimes occur, and leaf-hopper may have become troublesome. Care must be used in the employment of future sprays, avoiding as far as possible spray-stains. Heavy combination sprays, especially such mixtures as lime-sulphur, arsenate of lead, and Black Leaf 40, may be avoided. For the latest spray prior to picking, arsenate of lead only with a spreader will reduce stains to a minimum. The use of an excessive amount of lime leaves an objectionable white residue. Apple leaf-hopper, if allowed to become prevalent at this period, causes the fruit to become unsightly. Black Leaf 40, at 1-800, if applied at short intervals, will reduce this pest. Certain varieties, such as Dougherty, often develop black-spot quite late, and applications of lime-sulphur, 1-125, may be advisable up to the end of the coming month in a season when black-spot has been prevalent.

MISCELLANEOUS WORK.

Sanitary methods in and around the packing-shed should be exercised. Fruit affected with brown-rot and grubby apples and pears should be destroyed, as these are a prolific source of infection for the following season.

Cover-crops may still be sown if the land is in good order. A dressing of super., 3 cwt. to the acre, will benefit the cover-crop and give a far greater bulk of growth for ploughing under.

Grafts will still be making strong growth, and may require tying to prevent injury in strong winds.

Implements and the spray outfit, when finished with for the season, will have a longer life if given a little consideration. Place them under cover, and well grease all bearing surfaces.

Heavily laden trees may require some tying or propping. Every effort should be made by these means to prevent the splitting of trees or the fracture of large limbs.

Hail damage where very severe, having caused damage to foliage and bark, should not be accepted without making some effort to relieve the trees when in a weakened state consequent upon such injury, otherwise the effect will be felt in a marked degree in the following season. To more or less abandon the orchard till the next season is fatal. Removal of damaged fruit, and continuing with cultivation and disease control, will help to repair the loss and make possible the carrying of a crop the following season.

—N. J. Adamson, *Orchard Instructor, Hastings.*

Citrus-culture.

The most essential work at this period is conservation of moisture. Irrigation is not generally practised in the citrus-groves of New Zealand, but where water is available it could be done with great advantage to the trees during the dry period normally experienced in January and February. Several special points should be remembered when such watering is done. Applications should be adequate and periodic rather than a little and often. Endeavour should be made to get the lower soils saturated and the surface soil reworked to open condition in order to reduce evaporation. The best method of applying water is to ridge up the intervening land as though moulding potatoes, flood the trenches to at least equal $1\frac{1}{2}$ in. rainfall, and the following day, when the damp-soil has lost the sticky texture, cultivate the land to level back the ridges, thus leaving a mulch of dry crumbled earth on the surface. Surface watering gives rise to great evaporation, and besides consequent loss of water it has a tendency to encourage the roots to the surface. Where water is not available continue the surface cultivation of the soil, and if possible mulch with rough litter over the rooting-area.

Harvest all fruits as soon as ready; do not allow ripening fruits to develop on the tree and unduly tax it at this period of strain. Where for any reason trees have to be severely cut back this is the best season of the year to do so.

—W. H. Rice, *Orchard Instructor, Auckland.*

POULTRY-KEEPING.

GREEN FEED FOR HOT WEATHER.

JANUARY is usually one of the hottest and most trying months of the year for fowls of all ages. It is therefore important that they be given the best possible care and attention to ensure best results. It is a time when the birds require an endless supply of succulent green material for the maintenance of good health and vigour. Especially does this apply to the growing stock. It is common at this time for the birds to tire of their grain ration, and if not provided with an abundance of green food they will fail to thrive.

PROTRUSION OF THE OVIDUCT.

In the case of hens intended for table purposes—say, in March—it will be found a wise course to provide a forcing diet so that every possible egg may be secured before they are disposed of. A good supply

of boiled meat, meat-meal, or skim-milk added to the ration will tend to promote heavy egg-production. Of course, when providing a highly forcing ration there is always the risk that ovarian disorder will follow, such as protrusion of the oviduct. If trouble is experienced in this direction the forcing diet should be reduced by degrees until the trouble ceases. This is not to say that the whole flock should be kept back because the forcing diet has had an injurious effect on an odd bird or two. Poultry-keepers should use their own judgment in this respect.

There is, however, another, though more uncommon, cause of this part of the bird's anatomy becoming affected. It is frequently due to one or more birds in the flock acquiring the cannibal habit of picking at and puncturing the oviduct just when their mate is in the act of expelling her egg. As a result hæmorrhage sets in, and once this makes its external appearance after the bird leaves the nest it is soon attacked by its mates, with the result that the victim is caused a most cruel death. Indeed, due to both the causes referred to it is not uncommon to find dead birds in a house, where the other members of the flock have pulled out and eaten the greater part of the oviduct and intestines. On one plant where my advice was sought in regard to birds being found dead or bleeding from the vent, the owner informed me that he had lost four hundred pullets in a few months. He further informed me that from the commencement of the trouble all forcing foods had been eliminated from the ration. It was obvious to me, in view of past experience, that one or more members of the flock had acquired the cannibal habit referred to. Acting on my advice the owner immediately made the fronts of the nests deeper. The nests were also darkened by pieces of sacking tacked on to the front. In short, the nests were arranged in such a way that the culprit was unable to carry out its cannibal inclination. The owner has now advised me that from the time when he adopted preventive measures several months ago not a single bird has been lost from this cause.

CLEAN GROUND ESSENTIAL.

I cannot urge too strongly the importance of turning over every run possible, and sowing it down with a suitable green crop before the season becomes too late. This will not only have the effect of sweetening the soil and lessening the risk of disease and parasitic infection, but in addition the food thus grown will prove a valuable asset during the off season of the year. Moreover, such a run will make an ideal place for next season's young stock after they leave the brooder. The efficient poultry-keeper sees to it that his growing stock are always provided with a piece of clean ground to run on, and fully realizes that he is amply rewarded in the long-run for his trouble.

MORTALITY AMONG ARTIFICIALLY REARED CHICKENS.

Of late I have received many reports of heavy losses among chickens that were being artificially reared. In some cases the losses have been put down to some mysterious disease, while in others the particular make of brooder or brooders being used has been held responsible. It is true that the most experienced men in the business of poultry-keeping have much to learn in regard to artificial rearing, and it is only to be expected that the layman, or even the person with

some experience who does not possess a special aptitude in the work of brooder-management, will fail to always rear chickens with success. In the case of some of the plants where I have been requested to investigate the cause of the mortality I am fully convinced that improper management was solely responsible, and that the so-called epidemics did not exist; moreover, that the brooders being used were by no means at fault. It was the common fault of blaming everything but one's own understanding of the essentials which go to make success.

In the work of artificial chicken-rearing the point should never be lost sight of that the best brooder ever manufactured, or the best set of instructions ever framed, will fail to spell success if the person in charge of the rearing operations is incapable of thinking out things for himself and applying the knowledge of the necessary work which is now available. It is now generally recognized that to successfully manage poultry in large numbers the poultry-keeper must be a person of many parts. I have in my mind's eye men who have mastered to a high degree the important essentials regarding feeding, mating, culling of stock, &c., but who have sadly failed to rear the necessary chickens for the renewal of stock. There are so many things responsible for unsuccessful rearing by artificial means that it is necessary to look for the cause in many quarters. It is now too late, however, to talk of this for the present season.

— F. C. Brown, *Chief Poultry Instructor, Wellington.*

THE APIARY.

EXTRACTING.

EXTRACTING should now be in full swing in all districts. Where operations for any reason have been delayed care must be taken to see that the bees are not crowded out, or they will commence to loaf, and the ultimate crop will be small. It is good policy to extract twice during the season, but where the beekeeper prefers to leave the work until the end of the flow a close watch should be kept so as to provide ample room. This, however, can only be done where large numbers of spare combs are kept on hand. It is during the season when honey is coming in freely that the beekeeper realizes that his most valuable asset next to his bees is a good stock of extracting-combs. Every effort should be made to get at least twenty spare combs for each hive in the apiary, and with this number always on hand the bees are not likely to be hampered for room.

In the absence of plenty of drawn-out combs the best plan is to keep the extractor going, and thus prevent the bees from blocking the brood-combs. This usually happens unless ample room is provided, and as a result the queens are prevented from laying to their utmost and the colonies dwindle. At no time during the working season should the work of the queen be hindered. Care must be taken at all times to see to this important item during the flow. The honey is quite ready to extract when the combs are a half to three-parts capped, but great care must be exercised not to extract unripe honey. Numerous instances have come under my notice where the practice of taking unripe honey has meant a total loss to the beekeeper.

Removing Honey from the Hive.

The usual practice followed when the time for extracting is at hand is to remove the frames one by one. If excluders are used much time will be saved in picking over the combs. As the combs are taken from the hive shake the bees in front of the hive, brush off the remaining bees, and place the combs in a super for removal to the honey-house. The combs should be covered with a cloth which has been previously placed in water containing a small proportion of carbolic acid. When the season is at its height very little trouble will be experienced from robbers, but in case of a stoppage in the flow the foregoing precaution is necessary. At all times the beekeeper should study his working equipment, and this is specially important when removing the honey. It will be found convenient to provide a good barrow or truck for carrying at least two full supers. Much time and labour will be saved in this way, and the tedious work of removing the honey will be facilitated.

Uncapping.

One of the most important processes in the work of extracting is that of uncapping. There are several kinds of knives for the purpose on the market, but the stiff-bladed double-edged Bingham is usually first favourite. Two of these are necessary, and they must be stood in a pan of water which is kept boiling on a small lamp. Each knife as it becomes cold is returned to the boiling water and the hot one takes its place. Any contrivance which is used for an uncapping-can should be provided with a cross-bar through which to pass a screw or similar article, driven point upwards, to form a pivot on which to rest and revolve the combs. The comb should be placed with one end resting on the pivot and tilted slightly forward, in order to allow the cappings to fall away from the comb. Uncapping should commence at the bottom of the comb, and proceed with a sawing motion from side to side until the top of the comb is reached. The comb is then swung round on the pivot and the reverse side treated in the same manner. Only a thin sheet of wax should be removed, but it must be done thoroughly so that every cell is opened, and at the same time the top and bottom bars should be relieved of any burr-combs which may adhere to them.

A contrivance much in favour with progressive beekeepers is the steam-heated knife. This is a Bingham knife with a soldered copper plate, so arranged that steam is forced through it from a rubber tube attached to the spout of a "bronchitis" kettle. An escape-tube is fitted to the opposite side, and the knife is kept at a very high temperature all the time uncapping is proceeding, thereby obviating the work and trouble of continually plunging the knives into boiling water. For uncapping heavy fully capped frames it has no equal, since an ordinary uncapping-knife becomes cold as a rule before half one side of a full comb has been uncapped.

Strainers.

It is not uncommon to find exposed for sale honey with which proper care and attention have not been paid to straining at the time of extracting. Nothing deters the sale of extracted honey so much as a layer of wax-particles, dead bees, &c., and it is surprising how few beekeepers take the necessary trouble to see their product reaches the

customer free from wax and other impurities. In no case should honey be run direct from the extractor into the containers; it should be properly strained. It is the attention paid to this necessary detail that aids in the sale of the crop, and when honey is properly treated it readily commands a higher price. Fine-gauge wire strainers are usually adopted, but even these are not sufficient to remove the smaller wax particles. In order to ensure perfect condition the honey should be passed through good fine cheesecloth before being run into the tank. Cheesecloth strainers are excellent, cheap, and are easily made, while at the same time they can be readily cleansed. They remove everything but the smallest particles of wax, which should be finally disposed of when the honey is skimmed. This latter process is an important one, and should always be carried out before the honey is put up in marketable form.

SUPERSEDING QUEENS.

All old and failing queens should be superseded. It is a good plan to utilize surplus queens carried over in the nucleus hives to do the work. When due attention is given to requeening the apiary there is less likelihood of queenless hives in the spring. Remove all old queens in the apiary, and especially guard against wintering any colonies not headed by a vigorous mother.

TREATMENT OF FOUL-BROOD.

As advised last month, no effort should be spared to treat all colonies known to be affected with foul-brood. If the work is delayed the colonies will not build up to sufficient strength to winter safely. Under no circumstances should the work be put off. Treat all infected stocks while the flow is on, and endeavour to winter none but clean colonies. There is a great risk of spreading the disease to clean colonies in the off season, as robbing is more apt to break out. "Keep your bees clean" should be the maxim of every beekeeper. Where any doubt exists as to the complete absence of foul-brood in the apiary an excellent plan is to mark all combs with the number of the hives to which they belong, so that when extracted they may be returned to the colony from which they were taken. If this plan is followed, even if any of the hives are diseased, the risk of spreading infection by means of wet combs will be considerably reduced.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO HARVEST.

DURING February tobacco crops that were put out early in the season will commence to show signs of ripening. This is indicated by the green colour of the leaf gradually turning a paler shade, and decided yellow spots appearing between the main veins—in the lower leaves first—and gradually spreading to those higher on the stem. When the leaves half-way up the stem show these signs of ripeness the first suitable opportunity should be taken to harvest the crop.

In the past it has been customary to harvest the plants by splitting the stems nearly to the ground, then cutting them off at the surface of the ground and threading them on the curing-stick. The fresh sap thus exposed was a suitable medium for spores of moulds and other fungi, which often established themselves very quickly and spread to the leaves. This trouble has led to another system being sometimes adopted, which is to split the stems when the middle leaves are ripe, and then to allow the plants to remain standing for three to four days to allow the exposed sap to dry off before harvesting.

The more general way now, however, is to cut the plants off at the surface of the ground and to hang them on the curing-stick by tying the butts of two plants together. A curing-stick is about 4 ft. 3 in. in length. The stick is placed on tier poles, which run like parallel bars in the curing-shed. There they should be placed about 1 ft. apart to allow a draught of air to pass between the hanging plants. Later, as the plants dry the sticks may be closed, and thus provide more accommodation. The tobacco, however, must not be crowded, but enough space allowed to prevent plants touching. Also special care must be taken to carry out these operations without bruising or breaking the leaves.

It is important not only that the surface of the plants should be dry when harvested, but that the work should be done in fine weather, when the leaves are charged with the natural secretions that give the product its value, as during showery weather these are washed out by excessive transpiration.

A curing-shed charged from floor to ceiling with plants hung in this manner soon has a warm humid atmosphere at this season of the year. Under such circumstances the leaves gradually turn a yellow colour, when more air should be admitted to dry them off. This has to be done thoroughly, and special care should be taken to dry out the main stem of each leaf, for when this process is incomplete moulds are almost sure to develop in that area when the leaf is baled for marketing.

TOMATOES.

The end of the indoor tomato crop is usually reached during February, and the harvesting of the outdoor crop is then well under way. It is very bad economy to allow the glasshouses to remain empty and neglected at this period; they should be heavily fumigated and cleaned up without delay. A green cover-crop of quick growth should then be sown with a view to following up with crops of winter lettuce, which are now becoming more popular, or sowing down seed-beds of lettuce, cabbage, cauliflower, and onions for planting out in the spring.

The outdoor tomato crop will now probably require feeding to enable the plants to bring the crop to full maturity. In this application it will probably be beneficial to include a proportion of nitrogenous fertilizer. For two or three months the packing and selling of this crop will keep the grower busy. The method of delivering this product to the public has not always been of the best, and it is interesting to note that a conference of growers is about to be held, when this phase of the subject will doubtless be dealt with. Anything that will facilitate and expedite business with this perishable article should be

done, as there is a wonderful demand for tomatoes if they can be supplied regularly in a suitable manner. The subject of tomato by-products also requires more attention to enable the scandalous waste which sometimes occurs to be turned to use and profit.

BERRY FRUITS.

Between the rows of raspberries, currants, gooseberries, &c., it is sometimes customary to sow now a green cover-crop to turn in during the winter, and such a crop has the merit of smothering weeds as well as providing humus. The above-mentioned berry plants are often found affected with disease and in a starved condition. Plants affected with insect and fungus troubles should now be dealt with by suitable spraying. The starved condition of these bushes is too often due to deep ploughing and cultivation cutting up the fibrous roots which lie near the surface. Such treatment is very damaging to these crops, and specially so if it is done during the growing season.

Much the same remarks apply to the strawberry-beds. The runners, old leaves, and mulch should now be cleaned up and burnt, and the plants given suitable manures. In fine weather hoe the ground at suitable intervals to keep weeds under control.

In the Auckland District beds planted close in May or June bear heavy crops in the following November and December, the plants being afterwards ploughed in. In other districts where soil and climate are different the more conventional method of planting in early autumn and cropping the beds for four years is preferred. Where planting is to be done it should be carried out as soon as possible. It is important that the land should be rich, clean, firm, and smooth before planting; 9 in. between the plants and 2 ft. to 3 ft. between the rows is the usual spacing. Plants set now should make fine autumn growth and be in excellent condition for cropping next spring.

Where it is purposed to plant bush fruits during the coming planting season commencing in May, the land should be selected and prepared by subsoiling and manuring. There is no reason why it should not also carry an autumn crop of vegetables meanwhile, and so help pay for the cost of cleaning.

THE MARKET-GARDEN.

Important crops that are started this month are cabbage and cauliflower for spring cutting, and autumn onions for planting out in early spring. These are some of the most important crops in this section, and demand careful attention. A piece of land well drained and sheltered should be chosen for these seed-beds. They should be sown about the end of the month—rather earlier in southern districts and later in the North. A sowing now of lettuce and parsley will also be profitable in many instances.

Winter crops planted last month should be cleaned and fed occasionally to obtain good growth. The celery crop especially must not be allowed to become dry or stand still. Also feed well asparagus and rhubarb crops now making a recovery from the crop of sticks drawn during spring and early summer.

Harvest crops as soon as they mature, and follow up with another crop, even if it is only a green cover-crop. Autumn-sown onions will

now be ripening; their value depends very much on how they are harvested. They suffer very quickly if stored in a close atmosphere. They demand very dry, airy conditions to keep them well.

NATIVE PLANTS IN A NEW PLYMOUTH GARDEN.

It would doubtless be mistaken enthusiasm to recommend that a New Zealand garden should be confined to native plants, but there can be no doubt that every native plant of real use or interest should be given preference in the home garden and suitably displayed. If this were done native evergreens—than which there are none better—would take the place of the laurels and euonymus, &c., that are at present commonly planted. The karaka (*Corynocarpus laevigata*) makes an evergreen hedge that compares more than favourably with the cherry-laurel. It should be planted 2 ft. to 3 ft. apart, and the hedge kept narrow; it then makes an unbroken wall of foliage that is both ornamental and useful when rightly placed.

During a recent visit to New Plymouth some native plants were seen growing that are well worth noting. One of the most attractive was mairchau (*Phebalium nudum*), a shrub growing 6 ft. to 8 ft. high, that has not only a graceful appearance, but is very highly scented in all its parts. In a garden of any size a group of these plants would be a decided feature. In a native state it appears to be confined to the hilly forests of Auckland Province, but, like many such plants, it appears to thrive much farther south where it has the shelter of an established garden.

Another highly perfumed native plant growing there was the koheriki (aniseed *Angelica rosaefolia*), highly appreciated by shepherds as well as their flocks. In fact, stock are so fond of it that it is becoming scarce in a wild state, and shepherds often dry the leaves and rub them up in their tobacco to give it an aroma. Koheriki is a little plant 1 ft. to 2 ft. in height that is very suitable on rock-work in the open.

Parapara, the bird-catcher (*Pisonia Brunoniana*) is an evergreen with long handsome leaves and long narrow fruits that are extremely viscid, so much so that the smaller birds visiting the tree are often held prisoner. This tree, which grows to about 12 ft. in height, is suitable only for the warmer localities.

An attractive herbaceous plant with wide grass-like leaves and large light sprays of white flowers is rengarenga, the rock-lily (*Arthropodium cirratum*). It grows to a height of about 3 ft., and planted in a fairly large group in the foreground it cannot be overlooked.

These are mentioned here because the planting season is approaching. Planters who are now studying the subject in preparation for future action will no doubt appreciate these notes, which deal with our native plants from the point of view of their value in the home garden.

—W. C. Hyde, *Horticulturist*, Wellington.

Orchard-tax Act.—By notice gazetted on 6th December, 1928, the Hawke's Bay and the Thames Commercial Fruit-growing Districts, declared as such pursuant to the provisions of the Firelight Act, 1922, are made subject to section 4 of the Orchard-tax Act, 1927.

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

IN December, 1928, seventy-six certificates were issued under the C.O.R. system. Details of the records are given in the following list:—

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat reqd for Cent.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys	lb.		lb.	lb.
Elcho Hope ..	C. J. Masters, Hunterville	2 12	241·7	365	9,842·5	574·85
Ivondale Silver Rain-bow†	P. J. Petersen, Waitara ..	1 351	240·5	365	10,040·8	571·70
Elcho Catherine ..	C. J. Masters, Hunterville	1 361	240·5	365	8,202·5	552·98
Abberley Golden Flower	J. O'Donnell, Bunnythorpe	2 14	241·9	365	9,121·3	542·70
Ngahiwi Nancy Lee ..	W. J. Freeth, Pukearuhe ..	2 20	242·5	365	8,968·7	537·39
Pinewoods Golden Stella	G. H. Bell, Oakura ..	1 325	240·5	365	8,425·6	533·64
Ngahiwi Bilberry ..	W. J. Freeth, Pukearuhe ..	1 347	240·5	365	8,439·2	520·18
Pinewoods Viola's Beauty	G. H. Bell, Oakura ..	2 9	241·4	365	8,039·9	518·60
Abberley Sunflower ..	J. O'Donnell, Bunnythorpe	2 7	241·2	365	8,281·5	514·23
Ngahiwi Chalm ..	W. J. Freeth, Pukearuhe ..	1 343	240·5	365	8,733·0	514·13
Te Ngutu Nellie ..	J. Murray, Woodville ..	1 20	240·5	365	9,562·2	514·13
Elcho Xenia ..	C. J. Masters, Hunterville ..	1 363	240·5	365	8,616·5	510·26
Ngahiwi Waif ..	W. J. Freeth, Pukearuhe ..	2 3	240·8	353	8,625·2	487·21
Majesty's Figurehead	H. Allen, Kihikahi ..	1 237	240·5	365	7,792·4	485·38
Ngahiwi Lady Retford	W. J. Freeth, Pukearuhe ..	2 50	245·5	349	7,660·9	476·37
Ngahiwi Romance's Pet	W. J. Freeth, Pukearuhe ..	1 364	240·5	365	7,933·0	472·42
Pari Light ..	F. C. Butt, Opotiki ..	1 337	240·5	365	8,168·7	466·80
Hua Brook Sirona ..	H. Salway, Bell Block ..	2 71	247·6	365	8,559·3	427·25
Crofton Isabelle ..	Dr. C. G. Aickin, Auckland	2 30	243·5	365	7,246·7	427·23
Hua Brook Pride ..	H. Salway, Bell Block ..	1 311	240·5	364	8,125·3	417·64
Raeburn Briar ..	J. S. Rae, Taneatua ..	1 354	240·5	365	7,370·4	402·58
Patch's Wonder ..	H. R. Lancaster, Palmerston North	2 35	244·0	365	6,897·7	402·06
Runnymead Happiness	L. R. Fuller, Greenmeadows	2 13	241·8	365	7,209·8	387·62
Glenview Primrose ..	R. A. Paddon, Pukeatua ..	2 1	240·6	365	7,450·1	386·68
Jersey Meadows Fancy	L. R. Fuller, Greenmeadows	1 360	240·5	365	6,428·3	376·33
Tauwhare Claudia ..	Dr. C. G. Aickin, Auckland	2 37	244·2	365	6,675·3	363·54
Otterburn Blue Bell ..	G. Taylor, Point Chevalier	1 289	240·5	345	6,494·3	362·21
Vernon Xenia's Lady Supreme	G. R. and H. Hutchinson, Auckland	1 327	240·5	356	6,326·0	347·67
Velebit Kestons V.C.*	G. E. Yelchich, Waiuku ..	1 258	240·5	301	6,851·5	337·72
Lammermoor Belle ..	M. G. McArthur, Auckland	2 20	242·5	305	5,924·3	336·55
Hero's Ruby ..	R. A. Paddon, Pukeatua ..	2 6	241·1	361	6,845·6	332·42
Pinewoods Golden Patch	G. R. and H. Hutchinson, Auckland	2 2	240·7	365	5,881·2	320·91
Green View Dot ..	G. Taylor, Point Chevalier	1 323	240·5	326	5,088·8	310·55
Corra Lynn Rose ..	A. Best, Bombay ..	1 206	240·5	365	4,717·2	273·47
Senior Two-year-old.						
Pinewoods Viola's Silvery	G. H. Bell, Oakura ..	2 364	278·6	365	9,476·8	553·14
Palmdale Shirley ..	D. Kennedy, Morven ..	2 305	271·0	336	9,299·6	471·98
Ratoma Winnie ..	J. S. Rae, Taneatua ..	2 334	273·9	352	6,908·9	445·56
Sunhill Lovecharm ..	J. G. Holmes, Te Awamutu	2 193	259·8	365	7,498·0	416·14

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.						
		Yrs. dys.	lb.		lb.	lb.
<i>Three-year-old.</i>						
Carhuduff Silver Lily	J. O'Donnell, Bunnythorpe	3 359	312·9	365	11,810·0	685·29
Ashley's Gem ..	W. T. Dazeley, Pukekohe ..	3 359	312·9	365	10,057·3	617·60
Raeburn Pansy ..	J. S. Rae, Taneatua ..	3 192	296·2	365	9,250·6	566·48
Tauwhare Daisy ..	Dr. C. G. Aickin, Auckland	3 363	313·3	348	7,964·2	501·20
Laurelette* ..	G. E. Yelchich, Waiuku ..	3 359	312·6	365	7,566·7	474·01
Hua Brook Jolly Queen	H. Salway, Bell Block ..	3 16	278·6	365	8,028·5	473·07
Dorothy of Westown	R. A. Paddon, Pukeatua ..	3 26	279·6	365	8,995·6	435·43
Ferndale Briar's Lady	J. J. Springgay, Gisborne ..	3 31	280·1	307	8,096·3	434·20
Ivondale Sun Queen..	H. Salway, Bell Block ..	3 290	306·0	365	9,649·7	411·70
<i>Four-year-old.</i>						
Belvedere Gold Plume	Dr. C. G. Aickin, Auckland	4 340	348·1	365	11,832·6	614·66
Fury's Lucinda ..	H. Salway, Bell Block ..	4 265	340·0	365	8,649·8	562·33
Tauwhare Farry Girl	Dr. C. G. Aickin, Auckland	4 44	317·9	365	8,460·8	157·58
Tauwhare Faith ..	Dr. C. G. Aickin, Auckland	4 2	313·7	364	8,503·0	455·72
Sweet Juno's Pet ..	A. J. Harris, Bombay ..	4 15	315·0	337	6,841·1	453·69
Maid of all Work ..	Dr. C. G. Aickin, Auckland	4 206	334·1	362	8,551·5	443·08
Tauwhare Ann ..	Dr. C. G. Aickin, Auckland	4 17	315·2	365	7,694·7	422·42
Maid of Tauwhare ..	Dr. C. G. Aickin, Auckland	4 350	349·4	365	6,253·5	377·68
Roslyn Swannie Fox	A. J. Harris, Bombay ..	4 52	318·7	365	5,458·7	334·11
<i>Mature.</i>						
Calyptra† ..	P. J. Petersen, Waitara ..	5 297	350·0	365	11,416·7	611·59
Blue Silk ..	C. G. Wardell, Opaheke ..	12 297	350·0	294	9,290·1	519·64
Holly Oak Trixie ..	Dr. C. G. Aickin, Auckland	5 30	350·0	365	9,048·7	488·57
Lady Erica ..	A. Best, Bombay ..	5 304	350·0	365	9,499·2	486·89
Peach Blossom ..	C. G. Wardell, Opaheke ..	8 324	350·0	293	7,633·5	450·68
Royal Lass ..	J. S. Rae, Taneatua ..	6 286	350·0	310	9,222·3	475·95
Tecoma Primrose ..	M. G. McArthur, Auckland	6 79	350·0	365	9,384·3	448·01
Plum Blossom ..	C. G. Wardell, Opaheke ..	8 358	350·0	258	9,729·6	436·22
Creme de la Creme ..	Dr. C. G. Aickin, Auckland	5 348	350·0	365	7,191·7	424·16

FRIESIANS.						
<i>Junior Two-year-old.</i>						
Hanley Clover Omega*	G. H. Hassall, Clarkville ..	1 346	240·5	365	10,225·9	535·54
Dominion Lady	Central Development Farm,	1 345	240·5	329	9,765·4	348·07
Domino Woodcrest	Weraoa					
<i>Senior Two-year-old.</i>						
Fendalton Belle Posch 2nd*	J. I. Royds, Christchurch ..	2 226	263·1	282	8,082·8	277·58
<i>Senior Three-year-old.</i>						
Mahoe Myrtle Pontiac	R. A. Wilson, Bulls ..	3 269	303·9	361	11,095·5	436·03
<i>Junior Four-year-old.</i>						
Pareora Van Thumper Posch*	A. S. Elworthy, Timaru ..	4 29	316·4	365	14,481·6	516·49
<i>Senior Four-year-old.</i>						
Colinton Vida* ..	L. H. Leslie, Bennett's ..	4 311	344·6	365	19,294·9	640·06
<i>Mature.</i>						
Colinton Pietje Lass*	L. H. Leslie, Bennett's ..	5 13	350·0	365	18,010·6	570·77

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

MILKING SHORTHORNS.*Junior Three-year-old.*

Mereside Gem 1st*	W. Bowis, Doyleston	Yrs. dys.	lb.	lb.	lb.
		3 38	280·8	365	7,855·6

*Second-class Certificates.***Jerseys.***Junior Two-year-old.*

Hurden Fawn Beauty	H. Allen, Kihikihi	2 27	243·2	365	9,669·8	626·08
Glenview Madge	R. A. Paddon, Pukeatua	1 340	240·5	365	7,691·2	442·46
Meadowvale Florist	J. G. Holmes, Te Awamutu	1 358	240·5	365	7,519·4	420·76

Friesians.*Mature.*

Bainfield Topsy 14th*	J. I. Royds, Christchurch	6 312	350·0	365	20,606·9	785·30
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NOTE.—Ashley's Gem, appearing above in the Jersey three-year-old class, was inadvertently included in the four-year-olds as published in the November, 1928, *Journal*, and is now correctly listed.



WAIUKU DAWN (W. CRAIG, WAIUKU).

C.O.R. in Jersey Junior Two-year-old class: 10,023·7 lb. milk, 630·68 lb. butterfat.

STATISTICS OF PASTURE TOP-DRESSING ON FARMS, 1927-28.

Land District.	Superphosphate.		Basic Slag.		Other Artificial Fertilizers.		Stable and Farm Manure.		Lime.	
	Area.	Quantity applied.	Area.	Quantity applied.	Area.	Quantity applied.	Area.	Quantity applied.	Area.	Quantity applied.
	Acres.	Cwt.	Acres.	Cwt.	Acres.	Cwt.	Acres.	Cwt.	Acres.	Cwt.
North Auckland ..	160,021	457,447	67,214	218,834	47,636	149,817	827	7,378	7,378	56,379
Auckland ..	637,902	1,660,308	52,666	178,709	66,288	201,258	654	15,340	15,340	95,892
Gisborne ..	24,658	55,901	1,138	3,853	1,157	2,854	41	345	345	1,470
Hawke's Bay ..	74,808	166,631	3,154	7,434	4,589	10,260	9	1,710	1,710	11,309
Taranaki ..	111,104	273,611	104,649	273,235	14,789	39,463	313	9,317	9,317	28,628
Wellington ..	172,142	411,038	33,353	93,963	21,188	51,647	335	13,199	13,199	82,406
Nelson ..	14,942	32,229	2,041	4,813	728	1,629	79	1,678	1,678	27,456
Marlborough ..	14,146	25,065	172	321	284	513	28	321	321	2,576
Westland ..	2,697	6,593	36	177	877	2,085	93	841	841	6,788
Canterbury ..	41,160	72,431	887	1,791	3,404	5,594	393	5,345	5,345	39,495
Otago ..	36,518	73,026	2,600	6,916	7,488	22,256	272	16,422	16,422	197,893
Southland ..	79,352	171,618	9,057	22,679	16,711	46,155	106	46,228	46,228	480,986
Totals, 19 7-28 ..	1,369,050	3,405,808	276,967	812,695	518,199	533,531	3,150	118,124	118,124	1,031,278
Totals, 19 6-27 ..	985,162	2,353,550	262,768	758,769	161,859	482,648	4,475	106,995	106,995	788,035

NOTE.—I cases where farmers top-dressed the same areas with two or more of the fertilizers quoted, either separately or as a mixture, duplication of such areas under the appropriate fertilizer headings may have resulted. Consequently the actual total area top-dressed would be somewhat less than the sum of the areas appearing under the individual fertilizer headings.

—Census and Statistics Office.

REVIEW.

The Trees of New Zealand, by L. COCKAYNE, Ph.D., F.R.S., and E. PHILLIPS TURNER, F.R.G.S. New Zealand State Forest Service. 171 pages, 118 illustrations. Government Printer, Wellington. Price 4s. (cloth-bound copies extra).

ISSUED in the first place for the benefit of delegates to the Third British Empire Forestry Conference, 1928, this little volume admirably serves the further purposes aimed at by the authors. It enables the lovers of our indigenous trees—and they are many—to recognize them at once, whether they meet them in the wild or in the garden. They will find also authoritative accounts of the distribution and uses of the trees. The reviewer echoes the hope expressed in this sentence of the preface: "We also trust that it will come into the hands of many teachers of nature-study, and, above all, the senior pupils in schools, so that the latter may come to understand clearly what a priceless possession are these forests of theirs with the trees pure New-Zealanders, and that with such knowledge will arise a fixed determination that the areas of forest and other vegetation set aside as national parks, scenic reserves, and sanctuaries shall never be desecrated, but remain far into the distant future living examples of primeval New Zealand." The writer would like to see copies of the book placed in every primary school in the land, and especially in the smaller country ones.

Although botany is the Cinderella of the sciences taught in our secondary schools—a remarkable fact, when we pause to consider its importance for our economic welfare no less than our culture—Cinderella may yet come into her own, and this book would go a long way towards helping the scholars to help themselves to a knowledge of those "pure New-Zealanders"—our trees. "Notwithstanding the tropical character of the forest," say the authors, "how purely a New Zealand production it is may be seen from the fact that, leaving the ferns and their close relatives on one side, no less than 89 per cent. of the species [and we are told there are 290] are endemic, and if the ligneous plants be alone considered, all are pure New-Zealanders except three."

Chapter I deals summarily but interestingly with the general characteristics of our forests, which are stated to fall into two distinct subdivisions—subtropical rain-forest and subantarctic rain-forest. Accounts are given of the various groups to be found within these subdivisions—*e.g.*, coastal forest and swamp-forest. The factors influencing the composition of the forest, and the changes that occur as one travels from north to south and from coast-line to mountain-top, are explained, and statistics given of the component species. The absence from primitive New Zealand of grazing and browsing mammals is emphasized and its bearings discussed. All this will whet the appetite for more, but we are not told where further details may be found. Readers who wish to go deeper might start with "New Zealand Plants and their Story," and will find a full account in "The Vegetation of New Zealand," both from the pen of Dr. Cockayne.

Chapter II—the outstanding feature of the book—consists of a series of illustrations of 106 trees (mainly specimens of leaves, flowers, and fruit), accompanied by concise technical accounts of their characters and a statement of the distribution of each. Any one scared by the spectre of "technical terms" will soon be able to exorcise this, after all, feeble bogey by the help of the excellent glossary at the end of the book.

Mr. S. Gibson is to be heartily congratulated on the exceptionally fine series of photographs. It would be captious, perhaps, to suggest that in some cases even better results might have been obtained by slight modification of the background. So good, indeed, are the illustrations that in very few cases—*e.g.*, some of the "pines" and coprosmas—will the inquirer need to do more than compare a living specimen with the photographs to arrive at its proper name. Both technical and Maori names are given, and in some cases the "popular" name. There are pitfalls, however, in every scheme devised to reduce wild nature to order. It may be noticed, for instance, that in Fig. 13 the description reads "leaves *alternate*" (as in all text-books), while the spray illustrated shows the

less usual but still not uncommon form with leaves to all intents and purposes "opposite." It is important for the user of the book to note the scale of enlargement indicated on each photograph.

The chapter concludes with a key to certain species not illustrated, remarks on hybridism with photographs of certain hybrid swarms, and a list of known hybrid groups among our trees, followed by a brief note on epharmony—changes in form in response to changes in environment. The key, as far as the reviewer has tried it, appears to "work" fairly well, but one needs flowering and fruiting specimens to "get there." A student finding trouble in placing a specimen should, after arriving at the illustration most nearly fitting his case, consult the list of hybrids, as the source of his trouble may be there revealed. So rapid is the advance in our knowledge of wild hybrid groups that about six more could already be added to the list here published. A suspect that has considerable interest, and is at present being investigated, is a tree that is probably *Podocarpus spicatus* \times *totara*, recently discovered by Mr. G. V. Wild near Feilding. Space probably did not admit of a fuller discussion of epharmony, but an illustration of the great changes sometimes caused would have been useful—say, the remarkable case of *Nothofagus fusca* spoken of on page 146.

Chapter III deals with the timbers, and conveys a great deal of information in a short space. The authors limit themselves in this section to dealing with trees for the timber of which there is some demand. This certainly tends to induce a juster view of the relative importance of our trees from a timber-producing point of view, but one would have liked a little more detail concerning some of the trees dealt with, and of their other economic uses. Young farmers, especially, would have welcomed more information on the value of different trees from their point of view. Also very welcome would have been illustration of various sections of the timbers dealt with. But all this is really asking the authors for an additional book.

The glossary has already been mentioned, but the definitions of "vegetation" and "flora" on page 163, are specially recommended to the notice of newspaper reporters and "popular" writers in general.

The book is fittingly dedicated "To the Honoured Memory of Thomas Kirk, the author of the classical 'Forest Flora of New Zealand'." That it will fulfil the aims and hopes of the writers is certain.

H. H. ALLAN.

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates for the remainder of the season have been notified by agricultural and pastoral associations:—

Rangitikei A. and P. Association: Taihape, 23rd and 24th January.
 Horowhenua A. and P. Association: Levin, 29th and 30th January.
 Feilding A. and P. Association: Feilding, 5th and 6th February.
 Tauranga A. and P. Association: Tauranga, 5th and 6th February.
 Dannevirke A. and P. Association: Dannevirke, 12th and 13th February.
 Te Puke A. and P. Association: Te Puke, 13th February.
 Buller A. and P. Association: Westport, 15th and 16th February.
 Masterton A. and P. Association: Solway, 19th and 20th February.
 Whakatane A. and P. Association: Whakatane, 26th February.
 Opotiki A. and P. Association: Opotiki, 23rd February.
 Te Awamutu A., P., and H. Association: Te Awamutu, 20th February.
 Taranaki Metropolitan Agricultural Society: New Plymouth, 6th and 7th March.
 Morrinsville A. and P. Society: Morrinsville, 13th March.
 Hawke's Bay A. and P. Society (Autumn Show): Tomoana, 20th March.
 Mayfield A. and P. Association: Mayfield, 23rd March.
 Methven A. and P. Association: Methven, 27th March.
 Flaxbourne A. and P. Association: Ward, 18th April.

Correction.—In the first line of the section headed "catch-crops for green feed," on page 50 of this issue, the words "more humid" should read "sub-humid."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PERENNIAL CANARY-GRASS (*PHALARIS BULBOSA*).

W. H. HOMER, Tasman :—

I would be pleased if you could give me any information regarding perennial canary-grass (*Phalaris bulbosa*), time to sow, &c.

The Fields Division :—

Phalaris bulbosa has been tried (mostly in small plots) in various parts of New Zealand, and in some of the colder districts, when sown on heavy land, it has done fairly well. It has been included in pasture mixtures in some cases, but results have not been good. Its period of growth is during the cooler part of the year, but prairie-grass has proved superior when grown under similar conditions. The rate of seeding of *Phalaris bulbosa* is about 15 lb. per acre, and sowing can take place from about 1st October until the end of the year. The land should be well rolled prior to sowing, and the seed should be covered with a light brush harrow. This grass responds well to a dressing of superphosphate, which should be applied at time of seeding at the rate of 2 cwt. per acre.

CROSSBREEDING OF MUSCOVY DUCKS.

ROY SLEEP, Penrose :—

Kindly inform me whether it is possible to cross Muscovy and Aylesbury ducks, as the former take five weeks to hatch and the latter four weeks.

The Live-stock Division :—

We have no first-hand knowledge that these two breeds will cross. It is, however, commonly known that the Indian Runner, Mallard, and other breeds of duck will cross with the Muscovy. In the circumstances there is good reason to believe that the Aylesbury and Muscovy would cross. It is claimed by some authorities that the crosses produced by the Muscovy with other breeds of ducks are sterile, but this contention does not hold good in all cases if the opinions expressed by various authorities can be relied upon.

TROUBLE WITH HONEY.

“XYZ,” Otane :—

After taking my honey last season, and straining it without heating, I put it into jars. It did not set hard, but about one-third at the bottom went sugary, leaving the remaining two-thirds a runny brown liquid. The bees had abundance of clover, and there is no manuka within a few miles of the hives. Kindly explain the altered condition.

The Horticulture Division :—

The fact of your honey having changed its condition as described indicates either a separation of the two main sugars which constitute honey—levulose and dextrose—or that the honey has been slightly fermenting. The condition may be due to the honey not being ripe when taken from the combs, or through not being stored in airtight vessels during the winter months. Honey readily absorbs moisture from the atmosphere if not kept in a dry place, and fermentation sets

up. You do not mention whether the "runny brown liquid" is sour or otherwise, and a sample of the honey would be necessary in order to give a definite explanation of its altered condition.

BASIC SLAG FOR SOUTH CANTERBURY GRASSLANDS.

W. SIMPSON, Waimate :—

I would be obliged if you could advise me if basic slag (17-20 phosphoric acid, 80 per cent. fineness) would be suitable for top-dressing grassland here, and if the results would be as satisfactory as with superphosphate 44-46. The price of slag is £4 per ton Dunedin. Our land is on the downs, two miles from Waimate, in the Waituna district.

The Fields Division :—

We feel sure that on the type of soil and with the climatic conditions obtaining at Waituna basic slag will give good results in top-dressing pastures. Comparatively little basic slag has been used in Canterbury so far, but where it has been used along the foothills country results have been most satisfactory. To get the best results slag should be applied in April or May.

COST OF STARTING POULTRY-FARMING.

"POULTRY," Puni :—

Would you please state what is the initial cost in housing and for the purchase of all requirements to start poultry-farming with 500 to 750 hens ?

The Chief Poultry Instructor :—

The initial cost of purchasing land, and of fully equipping a poultry plant sufficiently large to accommodate from 500 to 750 hens would depend to a great extent on local conditions. The price of land, building-material, &c., and whether the site is flat or otherwise would all have an important bearing on the initial cost of the proposed venture. Furthermore, no mention is made as to whether or not it is proposed to hatch the necessary stock on the plant, or stock it with day-old chicks or young pullets bred by another. However, from a general standpoint, to purchase suitable land and provide the necessary buildings and equipment, the initial cost should run from £1 to £1 5s per bird.

PRESSING HAY DIRECT FROM FIELD.

R. B. N., Mount Somers :—

I would be grateful if you would give me some information regarding the pressing of hay direct from the field. (1) How long must the hay lie before being pressed to ensure against it becoming mouldy or heated ? (2) What is the best method of stacking the bales for storage purposes ? (3) What weight should be put into the bales if the hay has not been stacked ? (4) How long can pressed hay be stored and still retain its quality ?

The Fields Division :—

The system of pressing hay direct from the field has not proved altogether satisfactory in this country, such hay having often opened up in indifferent condition. However, under the best conditions and with proper technique some good results have been attained. In many cases the bales are too tightly pressed. If you decide to give the practice a trial it would be best to arrange for bales to be pressed somewhat loosely, which would necessitate three wires in place of two. Store in tiers where a good current of air can circulate around the bales. The weight of the bales should not exceed about 56 lb. If saved in really good condition and well protected from the weather, pressed hay should keep quite good for several years.

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR, 1928.

Dominion Meteorological Office.

GENERAL NOTES FOR DECEMBER.

DECEMBER was a very wet month over much the greater part of the Dominion. About double the normal rainfall was recorded on the average over the North Island and in Canterbury, Nelson, and Marlborough. In many places it was the wettest December for many years, and in some the wettest on record. Westland, parts of Central and Northern Otago, and Southland proved exceptions to the rule, having rainfalls below the average.

There was again a marked absence of westerly winds, while southerlies were rather unusually prevalent. The low rainfalls in Westland and Otago were associated with the lack of westerly winds. Gales were few and winds generally light.

Though the southerly winds caused cool temperatures in parts of the eastern districts, conditions were, on the whole, mild and humid. Few places experienced any severe cold snaps. The month resembled its predecessor in the frequency of thunderstorms. These occurred most widely on the 1st, 15th, 16th, 23rd, 29th, and 31st, but were recorded in some places also on the 2nd, 5th, 6th, 9th to 14th, 20th, 24th, 25th, and 28th.

The tendency for depressions to be of cyclonic form which has characterized the whole year was no less evident in December. On three occasions cyclones developed in the northern portions of depressions as they were crossing the Dominion. The first of these was on the 9th, when the cyclone appeared to the westward of the North Island. The centre passed through Cook Strait on the 10th. Moving slowly and being reinforced by the development of secondaries, the cyclone remained off the east coast until the 15th, when it gradually moved away. Southerly winds set in on the 10th, and continued in most districts for the remainder of the spell.

Very wet weather prevailed throughout the whole period, especially from the 9th to the 14th. On the 9th heavy rain was very general. A very severe hail-storm occurred on the 11th in the Napier district, and did serious damage to fruit crops and trees on a narrow line extending from Eskdale through Greenmeadows to Pakowhai. At some places stones up to 1½ in. in diameter were observed. On the 13th, when the cyclone became very intense, southerly gales were experienced at some places, temperatures dropped, and snow fell on the mountain-tops in both Islands. The period was reminiscent of that between the 12th and the 19th of December, 1927, when, however, the cyclones were centred farther eastward. Last year, also, the southerly winds were more severe and temperatures lower.

A rather intense depression moving from the westward caused northerly gales in Cook Strait and rain from Taranaki and Wellington southwards on the 19th. The second cyclone, which, however, was of only slight intensity, developed in the northern portion of this depression on the 20th.

The third cyclone followed the passage of a southern depression on the 24th. Its centre was in the far northern portion of the Tasman Sea, and did not pass away to the eastward until the 29th. This storm was responsible for very wet weather during the holiday season. Heavy and general rains were experienced in almost all districts, especially on the 25th or 26th and the 28th. Low-pressure waves of the westerly type kept the weather unsettled, especially in the South Island, until the end of the month.

—Edward Kidson, Director of Meteorological Services, Wellington.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	December, 1928				Calendar Year.	
		Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1928.	Average Rainfall
North Island.							
		Inches.		Inches.	Inches.	Inches.	Inches.
1	Kaitaia	5'00	11	2'00	3'28	59'55	50'87
2	Russell	4'79	13	2'25	2'65	54'01	51'79
3	Whangarei	5'73	16	1'04	3'11	79'60	61'75
4	Auckland	6'00	15	2'10	2'84	59'27	44'18
5	Hamilton	4'88	12	1'60	3'72	55'80	50'36
6	Kawhia	6'56	13	2'16	3'25	56'51	53'98
7	New Plymouth	8'10	15	2'82	4'33	57'25	60'35
8	Riversdale, Inglewood	9'36	18	2'63	7'43	91'71	104'48
9	Whangamomona	6'50	10	1'00	5'84	72'27	79'65
10	Eltham	6'37	12	1'83	3'83	56'34	52'43
11	Tairua	9'00	13	2'52	4'68	84'31	67'18
12	Tauranga	8'92	16	2'58	3'47	61'74	53'10
13	Marachako Station, Opotiki	5'45	9	2'75	2'74	51'37	52'82
14	Gisborne	6'44	11	3'38	2'10	50'66	46'94
15	Taupo .. ..	..	..	..	3'36	..	45'10
16	Napier	4'82	15	1'51	2'30	36'34	36'41
17	Marakakaho Station, Hastings	4'94	18	1'31	2'21	41'30	34'81
18	Taihape	6'10	18	2'55	3'42	37'98	40'01
19	Masterton	6'44	16	1'53	2'80	46'23	38'71
20	Patea	5'00	17	1'35	3'67	43'46	45'19
21	Wanganui	5'58	11	1'08	2'63	34'32	36'68
22	Foxton	5'74	12	1'30	2'51	37'11	31'88
23	Wellington (Karori)	8'82	16	2'41	2'99	62'01	45'24
South Island							
24	Westport	8'37	20	2'75	6'60	83'59	78'27
25	Greymouth	6'75	15	1'36	8'56	89'46	99'42
26	Hokitika	8'88	19	1'76	10'70	116'21	116'59
27	Ross	11'18	12	2'95	12'04	143'18	136'86
28	Arthur's Pass	8'31	10	2'12	14'93	165'58	156'61
29	Okuru, Westland	6'76	8	2'00	11'73	148'46	148'32
30	Collingwood	9'04	14	3'06	8'01	92'71	99'81
31	Nelson	8'69	15	2'26	2'69	41'21	37'84
32	Spring Creek, Blenheim	5'06	9	1'62	2'04	34'54	30'59
33	Tophouse	9'23	14	2'05	5'66	65'99	61'85
34	Hammer Springs	9'41	16	2'49	3'28	57'59	41'01
35	Highfield, Waiau	7'80	14	1'76	2'58	34'65	33'56
36	Gore Bay	5'14	16	1'23	2'77	38'70	31'21
37	Christchurch	6'00	14	1'41	2'06	23'77	25'30
38	Timaru	4'22	17	0'88	2'41	22'58	22'78
39	Lambrook Station, Fairlie	5'70	14	0'90	2'58	26'49	24'98
40	Benmore Station, Clearburn	3'53	14	0'78	2'13	30'46	24'79
41	Oamaru	3'62	12	0'86	2'15	20'52	21'82
42	Queenstown	2'05	13	0'80	2'59	35'58	30'64
43	Clyde	1'96	10	0'58	1'79	16'68	15'23
44	Dunedin	3'88	16	0'90	3'48	30'15	30'96
45	Wendon	3'13	12	0'98	2'76	30'22	30'27
46	Gore	3'15	14	0'97	3'33	34'35	34'41
47	Invercargill	3'43	17	0'80	4'26	43'71	45'08
48	Puysegur Point	5'00	20	1'12	6'63	99'58	83'61
49	Half-Moon Bay, Stewart Island	2'60	10	0'90	5'69	58'89	58'70

LATEST EXPORT EXAMINATION DATES FOR APPLES.

Following are the latest dates of receiving at inspection points for export fruit the respective varieties of apples grown in the districts specified :—

1. Varieties in Alphabetical Order.

Variety.	Auckland.	Gisborne and Hastings	Marlborough.	Nelson Province.	Wairarapa and Canterbury.
Adams Pearmain ..	15 Mar	23 Mar.	23 Mar.	29 Mar.	12 April
Alfriston ..	5 "	5 "	8 "	11 "	21 Mar.
American Horn ..	20 April	20 April	22 April	25 April	30 April
Baldwin ..	25 Mar.	25 Mar.	31 Mar.	3 "	12 "
Ballarât Seedling ..	10 May	10 May	10 May	10 May	12 May
Blenheim Orange ..	2 Mar.	5 Mar.	7 Mar.	17 Mar.	20 Mar.
Boston Russet ..	18 "	18 "	31 "	3 April	10 April
Brighton ..	12 May	12 May	12 May	12 May	12 May
Brownlee's Russet ..	10 April	10 April	20 April	25 April	30 April
Celo ..	3 May	3 May	3 May	3 May	12 May
Cleopatra ..	5 April	5 April	5 April	12 April	12 April
Cox's Orange ..	4 Mar.	4 Mar.	14 Mar.	14 Mar.	25 Mar.
Crofton ..	10 May	10 May	10 May	10 May	12 May
Delicious ..	12 April	12 April	10 April	16 April	20 April
Dougherty ..	12 May	12 May	12 May	12 May	12 May
Dunn's ..	31 Mar.	31 Mar.	7 April	7 April	18 April
Edward Lippiatt ..	20 April	20 April	20 "	25 "	30 "
Frimley Beauty ..	30 "	30 "	30 "	3 May	5 May
Golden Pippin ..	28 Feb.	28 Feb.	28 Feb.	28 Feb.	28 Feb.
Golden Russet ..	18 Mar	18 Mar.	24 Mar.	28 Mar.	5 April
Granny Smith ..	12 May	12 May	12 May	12 May	12 May
Gravenstein ..	10 Feb.	10 Feb.	10 Feb.	10 Feb.	20 Feb.
Hoover ..	2 April	2 April	6 April	16 April	16 April
Jonathan ..	30 Mar.	30 Mar.	31 Mar.	12 "	18 "
King David ..	15 "	15 "	20 "	29 Mar.	31 Mar.
London Pippin ..	30 "	30 "	31 "	3 April	6 April
Lord Wolseley ..	25 "	25 "	31 "	3 "	18 "
Newtown Pippin ..	30 April	30 April	2 May	3 May	10 May
McIntosh Red ..	10 Mar.	10 Mar.	12 Mar.	15 Mar.	25 Mar.
McLiver's Winesap ..	20 April	20 April	25 April	30 April	30 April
McMahon's White ..	5 "	5 "	8 "	9 "	14 "
Parlins Beauty ..	20 Mar.	20 Mar.	20 Mar.	3 "	3 "
Pioneer ..	25 April	25 April	25 April	10 May	10 May
Premier ..	20 Mar.	20 Mar.	24 Mar.	3 April	5 April
Ribston Pippin ..	23 Feb.	25 Feb.	28 Feb.	10 Mar.	10 Mar.
Rokewood ..	12 May	12 May	12 May	12 May	12 May
Rome Beauty ..	25 April	30 April	30 April	10 "	10 "
Salome ..	10 "	10 "	10 "	12 April	14 April
Scarlet Nonpareil ..	31 Mar.	31 Mar.	5 "	7 "	12 "
Scarlet Pearmain ..	10 Feb.	12 Feb.	12 Feb.	14 Feb.	25 Feb.
Senator ..	25 Mar.	25 Mar.	31 Mar.	3 April	12 April
Shepherd's Perfection ..	18 "	18 "	21 "	25 Mar.	5 "
Shorland Queen ..	14 "	14 "	14 "	15 "	25 Mar.
Simmonds' Winter ..	10 April	10 April	20 April	25 April	30 April
Spitzenberg ..	18 Mar.	18 Mar.	21 Mar.	25 Mar.	5 "
Statesman ..	10 May	10 May	10 May	10 May	12 May
Stark ..	10 April	10 April	10 April	20 April	20 April
Stayman's Winesap ..	5 "	8 "	8 "	14 "	14 "
Sturmer ..	12 May	12 May	12 May	12 May	12 May
Stone Pippin ..	12 "	12 "	12 "	12 "	12 "
Tasma ..	12 "	12 "	12 "	12 "	12 "
Wagner ..	5 April	5 April	8 April	9 April	15 April
Willie Sharp ..	28 Feb.	28 Feb.	28 Feb.	28 Feb.	28 Feb.
Worcester ..	10 "	12 "	12 "	14 "	25 "
Yates ..	12 May	12 May	12 May	12 May	12 May

2. Date Order for Varieties.

Variety.	Auckland.	Gisborne and Hastings.	Marlborough.	Nelson Province.	Wairarapa and Canterbury.
Gravenstein ..	10 Feb.	10 Feb.	10 Feb.	10 Feb.	20 Feb.
Scarlet Pearmain ..	10 "	12 "	12 "	14 "	25 "
Worcester Pearmain ..	10 "	12 "	12 "	14 "	25 "
Golden Pippin ..	28 "	28 "	28 "	28 "	28 "
Willie Sharp ..	28 "	28 "	28 "	28 "	28 "
Ribston Pippin ..	23 "	25 "	28 "	10 Mar.	10 Mar.
Blenheim Orange ..	2 Mar.	5 Mar.	7 Mar.	17 "	20 "
Cox's Orange ..	4 "	4 "	14 "	14 "	25 "
Alfriston ..	5 "	5 "	8 "	11 "	21 "
McIntosh Red ..	10 "	10 "	12 "	15 "	25 "
Shorland Queen ..	14 "	14 "	14 "	15 "	25 "
King David ..	15 "	15 "	20 "	29 "	31 "
Adams Pearmain ..	15 "	23 "	23 "	29 "	12 April
Shepherd's Perfection ..	18 "	18 "	21 "	25 "	5 "
Spitzenberg ..	18 "	18 "	21 "	25 "	5 "
Golden Russet ..	18 "	18 "	24 "	28 "	5 "
Premier ..	20 "	20 "	24 "	3 April	5 "
Boston Russet ..	18 "	18 "	31 "	3 "	10 "
Parlins Beauty ..	20 "	20 "	20 "	3 "	3 "
Baldwin ..	25 "	25 "	31 "	3 "	12 "
Senator ..	25 "	25 "	31 "	3 "	12 "
Lord Wolsley ..	25 "	25 "	31 "	3 "	18 "
London Pippin ..	30 "	30 "	31 "	3 "	6 "
Jonathan ..	30 "	30 "	31 "	12 "	18 "
Scarlet Nonpareil ..	31 "	31 "	5 April	7 "	12 "
Dunn's ..	31 "	31 "	7 "	7 "	18 "
Hoover ..	2 April	2 April	6 "	16 "	16 "
Cleopatra ..	5 "	5 "	5 "	12 "	12 "
Stayman's Winesap ..	5 "	8 "	8 "	14 "	14 "
McMahon's White ..	5 "	5 "	8 "	9 "	14 "
Wagner ..	5 "	5 "	8 "	9 "	15 "
Salome ..	10 "	10 "	10 "	12 "	14 "
Stark ..	10 "	10 "	10 "	20 "	20 "
Brownlee's Russet ..	10 "	10 "	20 "	25 "	30 "
Simmonds' Winter ..	10 "	10 "	20 "	25 "	30 "
Delicious ..	12 "	12 "	16 "	16 "	20 "
American Horn ..	20 "	20 "	22 "	25 "	30 "
Edward Lippiatt ..	20 "	20 "	20 "	25 "	30 "
McLiver's Winesap ..	20 "	20 "	25 "	30 "	30 "
Rome Beauty ..	25 "	30 "	30 "	10 May	10 May
Pioneer ..	25 "	25 "	25 "	10 "	10 "
Newtown Pippin ..	30 "	30 "	2 May	3 "	10 "
Frimley Beauty ..	30 "	30 "	30 April	3 "	5 "
Celo ..	3 May	3 May	3 May	3 "	12 "
Statesman ..	10 "	10 "	10 "	10 "	12 "
Ballarat ..	10 "	10 "	10 "	10 "	12 "
Crofton ..	10 "	10 "	10 "	10 "	12 "
Grannie Smith ..	12 "	12 "	12 "	12 "	12 "
Tasma ..	12 "	12 "	12 "	12 "	12 "
Stone Pippin ..	12 "	12 "	12 "	12 "	12 "
Sturmer ..	12 "	12 "	12 "	12 "	12 "
Brighton ..	12 "	12 "	12 "	12 "	12 "
Dougherty ..	12 "	12 "	12 "	12 "	12 "
Rokewood ..	12 "	12 "	12 "	12 "	12 "
Yates ..	12 "	12 "	12 "	12 "	12 "

LICENSED MEAT-EXPORT WORKS IN NEW ZEALAND, SEASON 1928 - 29.

Name and Address of Licensee.	Name and/or Location of Works.	Bed-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcasses Mutton.
<i>North Auckland and Auckland.</i>				
Auckland Farmers' Freezing Company, Ltd., Auckland	Moerewa ..	200	2,000	100,000
" " "	Southdown ..	200	3,000	202,000
" " "	Horotiu ..	200	3,000	218,000
Westfield Freezing Company, Ltd., Auckland..	Westfield ..	250	3,000	205,000
R. and W. Hellaby, Ltd., Auckland ..	Westfield ..	120	500	3,000
<i>Hawke's Bay.</i>				
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch..	Pakipaki ..	30	1,800	70,000
Nelsons (N.Z.), Ltd., Tomoana ..	Tomoana ..	150	5,000	180,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings..	Whakatu ..	80	4,000	80,000
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa ..	Wairoa ..	100	3,000	165,000
<i>Gisborne..</i>				
Nelsons (N.Z.), Ltd., Gisborne ..	Waipaoa ..	150	3,500	270,000
Gisborne Sheep-farmers' Frozen Meat and Mercantile Company, Ltd., Gisborne	Kaiti ..	150	4,000	422,000
Ditto ..	Tokomaru Bay	60	3,000	140,000
<i>Taranaki.</i>				
Thomas Borthwick and Sons (Aus.), Ltd., Waitara ..	Waitara ..	200	2,000	80,000
J. C. Hutton (N.Z.), Ltd., Wellington ..	Eltham ..	60	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	150	2,000	180,000
<i>Wellington.</i>				
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	271,000
Felding Farmers' Freezing Company, Ltd., Felding ..	Aorangi ..	100	4,000	153,500
National Mortgage and Agency Company of New Zealand, Ltd. (Head Office, Dunedin)	Longburn ..	60	2,000	100,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch	Waingawa ..	120	5,000	150,000
Gear Meat Preserving and Freezing Company of New Zealand, Ltd., Wellington	Petone ..	100	10,000	300,000
J. C. Hutton (N.Z.), Ltd., Wellington ..	Ngahauranga ..	120	3,000	120,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	240,000
" " "	Kakariki* ..	100	2,000	90,000
<i>Marlborough and Nelson.</i>				
New Zealand Refrigerating Company, Ltd., Christchurch	Picton ..	30	2,000	30,000
Nelson Freezing Company, Ltd., Nelson ..	Stoke ..	30	500	50,000
<i>Canterbury.</i>				
Canterbury Frozen Meat and Dairy Produce Export Company, Ltd., Christchurch	Belfast ..	120	6,000	252,000
Ditto ..	Fairfield ..	..	4,000	100,000
" " "	Pareora ..	25	4,500	233,000
New Zealand Refrigerating Company, Ltd., Christchurch	Islington ..	50	7,000	375,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Smithfield ..	50	6,000	304,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch..	Kaipoi ..	100	4,000	222,000
" " "	Belfast ..	..	5,000	120,000
<i>Otago.</i>				
Waitaki Farmers' Freezing Company, Ltd., Oamaru ..	Pukeuri ..	..	3,500	230,000
New Zealand Refrigerating Company, Ltd., Christchurch	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	50	2,500	200,000
<i>Southland</i>				
Ocean Beach Freezing-works (J. G. Ward and Co., Ltd., Managing Agents), Invercargill	Ocean Beach ..	50	2,500	110,000
Southland Frozen Meat and Produce Export Company, Ltd., Invercargill	Mataura ..	50	2,500	104,000
Ditto ..	Makarewa ..	120	2,500	75,000
Tait's Woodlands Meat Company, Ltd., Invercargill ..	Woodlands† ..	..	..	..
Totals	3,745	135,800	6,465,500

* Not operating.

† Canning only.

—Live-stock Division.

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No. 2.

DAIRY-COW DISEASES IN NEW ZEALAND.

RECENT RESEARCH WORK BY DEPARTMENT OF AGRICULTURE.

Paper read by C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory, at the New Zealand Institute Science Congress, Auckland, January, 1929.

THREE diseases are to be discussed in this paper. Two of these have been well known all over the world for many years—namely, contagious abortion and mastitis (mammitis), while the third, a more recent arrival, has become noticeable in the last twelve years and is known as “temporary sterility” or “return to the bull.”

Dr. J. A. Gilruth, and associated with him Dr. C. J. Reakes and Mr. H. A. Reid, have all done considerable work here on contagious abortion and on mastitis, but, although they have helped to throw more light on these diseases, they have not had better results with treatment than European workers. On account of the great economic losses associated with dairy-cow diseases in this country, a further effort by a team of workers has been for some time in progress in an attempt to find definite curative and preventive measures for combating the three major diseases. The team is composed of four veterinarians of the Department of Agriculture—Messrs. C. V. Dayus and W. M. Webster in the field, and C. S. M. Hopkirk and D. A. Gill in the laboratory—with the help of field officers of the Livestock Division in general and of the Department's Chemical Laboratory for the analysis of nastur. It is proposed in this paper to deal with our work up to date in the field and in the laboratory, and to incorporate some of the theories leading up to the lines of work attempted. At this stage it must be pointed out that a knowledge of the causative organism of any one disease does not necessarily mean that the disease can be easily cured or protected against. The diseases will be dealt with in the order of mastitis, abortion, and temporary sterility.

MASTITIS.

Mastitis (inflammation of the udder) is known to the farmer as contagious mammitis, and was at one time differentiated from a non-contagious form. This differentiation no longer exists, and the

point requires stressing that all mastitis in the herd must be looked upon as contagious, even though it be not of streptococcic origin. Mastitis is a localized disease of one or more quarters of the udder, and it increased considerably after the introduction of the milking-machine. There is little doubt that the streptococci as a group are the organisms responsible for the enzootic forms of the disease in dairy cows. Acute cases of mastitis are found both culturally and microscopically to contain streptococci, often alone, but sometimes associated with other micrococci which may or may not increase the inflammation and resulting induration, but which are usually harmless saprophytes of the normal udder. At the present time we are not interested in other definite forms of mastitis, such as pure staphylococcic, or infection due to *Bacillus coli*, *Bacillus aerogenes*, or *Bacillus pyogenes bovis*. These are not uncommon forms, but do not compose $\frac{1}{2}$ per cent. of the cases of mastitis examined at Wallaceville.

The streptococci have been placed in a group as causative of mastitis mainly because of the difficulty experienced in obtaining uniform reactions on media in the growth of organisms isolated from typical cases of the disease, and from the fact that occasionally strains have been isolated which differ decisively from the majority and resemble in some cases *Streptococcus lactis* and in others a morphologically different streptococcus of faecal origin.

The organism mainly responsible gives the following reactions to media as a general rule :—

Morphology : Palisade growth in long, winding chains, in samples from acute cases. The length of the chains may alter considerably and in less acute cases they may be difficult to find, may be phagocyted, and, if found, are in chains of four to six individual spherical cocci. Cultural growth : The optimum temperature is that of body-heat, but no growth occurs at 10° centigrade in milk as in *Streptococcus lactis*. Sugar broth cultures (broth alone is not conducive to growth) of pH 7·2* gives a flocculent deposit, except in rare cases where turbidity is produced, in which case streptococci are present in very short chains. Sugars are not uniformly broken down, but there is usually acid and no gas production in glucose, lactose, saccharose, and salacin. No reaction occurs in inulin, nor usually in raffinose or mannite. Lactose litmus agar pH 7·2 gives an acid reaction to growth in twenty-four hours, and colonies may vary. Often one finds a smooth, entire, dome-shaped colony in twenty-four hours, which at forty-eight hours may give place to a flat, slightly ragged, rough, concentrically ringed colony, which resembles the rough type as opposed to the first smooth. Dissociation from smooth to rough is now a feature in streptococcal work and will be referred to later. **Serum :** Non-liquefying colonies similar to lactose litmus agar. **Blood agar :** Usually non-hæmolytic (no action on blood), yet on occasion green-tinged colonies have been noticed. **Milk :** Is coagulated in twenty-four hours usually, but sometimes takes forty-eight ; acidity about 0·62 to normal sodium hydroxide with indicator phenol-phthalein. **Methylene blue :** Inhibits growth in milk. Rats or mice are not affected by intra-peritoneal injections.

* pH refers to the hydrogen ion concentration of a substance, and is known as the "reaction." Above the neutral 7·0 a fluid is alkaline, below 7·0 acid.

The main lines of work which are being pursued with regard to mastitis are (1) diagnosis of the disease, (2) path of infection, (3) treatment and prevention.

(1) **Diagnosis.**

In order that the incidence of mastitis in herds may be correctly judged, so that the owner may eliminate the disease, reliable diagnostic methods must first be obtained. Manipulation of the udder is not reliable, as it fails to pick out many intermediate and other cases. A fine gauze strainer used for the fore milk is helpful in the more acute or in subacute cases.

The method of employing delicate indicator fluids soaked up and dried on blotting-paper has been attempted, the indicators being methyl red, neutral red, azolitmin, phenolphthalein, brom thymol blue, brom cresol purple, and Andrade's indicator. A slight reaction may be obtained with methyl red in acute cases, and a definite purple reaction with brom cresol purple, but the others are of little use. Brom cresol purple is at present being tried out on known herds, but is not likely to be entirely successful, because the chronic types of disease are not readily picked out by it.

Agglutination tests have been to some extent successful in the few attempted, and the records show the only sound cow in twelve to have been picked out; but the method is cumbersome, the antigen not stable, and antibody in the sera weak. The results, too, do not give one the picture which the microscopical test can. There is a recently perfected rapid agglutination method which is yet to be tried as opportunity offers.

The microscopical test is made after the milk-sample, which comprises the first strippings from the quarter, has been allowed to stand about one or two hours, the optimum being two hours. A loopful of the top layer, be it cream or other floating material, is then smeared over a glass slide, dried, and stained with Loeffler's methylene blue. Carbol thionine blue is unsatisfactory, and the gram stain shows only the organisms and not the leucocytes, besides taking up considerable time in preparation. An oil-immersion one-twelfth lens then shows the number of leucocytes in the secretion, and, if present in numbers, the causative organism. The examiner may then state the condition of the quarter—whether affected acutely, subacutely, or chronically. Because of the large number of milk-samples which one has to examine microscopically, no time can be devoted to an accurate count of the numbers of leucocytes to the cubic centimetre of milk. Therefore a practical method was required for comparison, and that was supplied by the symbols L_1 , L_2 , L_3 . Later intermediate signs were added— $L_1 +$, $L_2 +$ —giving, in all, six headings for comparison.

The correlation of results of many hundred milk-samples examined repeatedly shows that with experience the examiner is remarkably accurate in classifying the samples. The incidence of mastitis in herds in this country varies considerably, the numbers of cows affected being at present worked out in data from many experimental herds.

The microscopical test *cannot be doubted* after following histories of known cows for several years and of herds of cows for upwards of two years, except possibly where there is a fresh attack with *Bacillus*

abortus or where vaccinia is present on the udder-surface. Speaking of abortion infection, it may be dismissed at this stage by saying that little evidence can be produced, as certain workers in America claim, to show any connection between abortion and streptococcic mastitis, though *Bacillus abortus* may possibly set up acute inflammation of the quarter for some days, but with little or no induration. This statement is made after examination of herds throughout the country for both diseases.

Many cows during their milking career are at some time affected with streptococcic mastitis in an acute or chronic form, whether it be for a few days' or a few weeks' duration. This acute form subsides into a subacute and then into a chronic type, where the streptococcus is present in very small numbers but where some induration of the quarter may possibly be noticed. The streptococci themselves, however, do not wholly leave the udder tissue, but may persist for years. Cultural examination of milk in acute cases usually shows a pure streptococcic infection. From subacute cases streptococci and staphylococci—some 50 per cent. of each—are obtained. In chronic cases only a few streptococci are found, but an increase of staphylococci. These latter persist in great numbers in injured quarters, but during exacerbation of the acute inflammation—when streptococci, &c., appear in greater numbers for the time being—they disappear almost entirely. Examination of a number of normal cows of known history has been undertaken to show that no streptococci are ever found in the quarters in which leucocytes are not present and which are known to have been normal always; but in the majority of such quarters the coccus present in chronic cases is found to be living quite harmlessly and saprophytically. Very few normal quarters are actually sterile. However, if a culture of this saprophytic coccus is injected into the udder, and the balance between the body cells and organism is thus upset, then a violent mastitis will result, the cow being obviously unwell, and running a temperature, and the quarter much swollen, hot, and painful, with an inclination to abscess-formation. This form of mastitis is apparently staphylococcic, and may exacerbate when the cow is dry, producing a large, swollen, fleshy gland before milk is produced in the udder, and is totally different from streptococcic mastitis.

(2) Path of Infection.

This is the biggest problem which we are up against in streptococcic mastitis. How, when, and why does the streptococcus reach and attack the udder tissue?

So far the setting-up of mastitis by various means has been, except when the organism is directly introduced into the quarter, of a negative nature. No mastitis occurs with intravenous injection of culture; drenching of the lactating cow with large quantities of affected milk does not produce the disease, but may set up scouring; inoculation through the mucous membrane of the mouth and instillation of culture into the eye are ineffective. No results have been obtained by milking with hands washed in affected milk, or by leaving affected udder secretion on the ends of the teats over a period of a week on a number of cows. Injection of streptococci into the

uterus of a recently calved cow proved ineffective ; yet one cow given acute strep. mastitis by injection of streptococci into a quarter later aborted a foetus through streptococcic metritis, an unusual occurrence at Wallaceville, where no such case had previously occurred. This incident gives food for thought, but has not recurred.

The only method left to produce mastitis experimentally is to introduce the organism into the teat-sinus. Not only must the organism be introduced, but it is also required that the organism be of a definite type or that injury of the quarter also exists, to produce a lasting inflammation. On several occasions flocculating lactose broth cultures have produced an acute inflammation for a few days, but this has disappeared, leaving, as far as can be judged, no permanent impairment. If, however, we give udder secretion containing the streptococci as found in acute strep. mastitis, then acute mastitis follows, and the animal has typical acute streptococcic mastitis, known to the farmer as contagious mammitis. The disease does not require secretion from the acute stage of the disease only to be passed on to a cow, but milk from chronic cases which are macroscopically normal may set up inflammation. In one recent case, where a chronic milk was inoculated into a normal quarter of a clean cow, the result was a chronic type of inflammation, which took four days to show up macroscopically, but which on the third day showed a pure culture of streptococci. A second case was to some extent accidental, but this also took five days to show up, as follows : The effect of acid solution was being tried on a cow in quarters showing chronic mastitis and in those apparently normal. Normal saline solution of pH 6.5 was used, 100 cc. being introduced. The affected quarter was injected first, and then, after rinsing the teat-tube only in boiled water, a second normal quarter was injected. A third quarter, also normal, was then injected by means of a sterile teat-tube as a control. Mastitis showed up acutely on the fifth day in the second quarter, but subsided quickly to a subacute stage. In the affected quarter, however, acute mastitis became evident in a few hours, while the third normal quarter remained normal. There could have been very few streptococci placed in the second quarter, but they were able, nevertheless, to produce mastitis, and were helped, possibly, by the acid solution. Although streptococci were originally present in large numbers in the acute stage of the accidental case of mastitis, yet later staphylococci developed in large numbers, with only a few streptococci to be seen in culture amongst them.

The acid experiment was carried out because of recent work on dissociation of organisms into rough and smooth and intermediate types, and this dissociation has recently been shown to exist in the streptococcic group by an American worker. The rough type is a resistant organism, not nearly as pathogenic as the smooth type. The rough prefers more alkaline fluids, while the smooth prefers the acid range. Therefore on the introduction of acid to a chronic case it is possible that there was a change from rough to smooth in the quarter, with consequent acute inflammation. There is such an outpouring of alkaline fluid into an acutely infected quarter from the body that one would expect the smooth to give place after a while to the rough type, and thus acute mastitis would become chronic and the organism resistant.

If this theory is correct, it fully explains the method of attack of this organism and the reason for chronicity in the affected quarter. For some time it has been recognized that some other factor than the streptococcus itself existed. This factor was postulated as injury. We may in theory look upon injury, by whatever means it occurs in the udder—chill, knocks, milking-machines, hand-stripping, cow-pox, digestive disturbances, &c.—as causing an excess of lactic-acid production in the tissue of the part; and by this means smooth types are able to take hold and set up an acute inflammation of a part which at the time of invasion was debilitated by an acidosis and not actually inflamed. The exacerbation from the chronic type differs only in that the organism is present and requires the acidosis for setting up a more toxic condition. It is believed that milking-machines may become a serious source of injury when they are employed for too long a time on individual cows or at too high a pressure, and field reports confirm this. In our attempt to establish further this acidosis theory, a cow at Wallaceville has recently been fed on ammonium chloride in large doses to set up a general systematic acidosis. This cow was infected with mastitis four years ago during vaccine experiments, and has remained more or less chronic, with temporary exacerbation, ever since. At the time of the experiment two quarters were affected in a chronic form. Towards the end of three days' feeding one of the quarters showed a subacute mastitis which existed for a week after the finish of the feeding. The case did not become acute, but in becoming subacute showed possibilities, and the experiment will be repeated.

How infection takes place cannot be said at present. It may under exceptional circumstances be blood-borne in septicæmic conditions, but such cases must be rare. Infection apparently is usual through the teat-orifice. Experiments show that if only a very small number of organisms gain entrance it may take five days to show up. On the other hand, a massive infection or an infection with a more virulent type may show up in a few hours. Assuming the quarter is in a fit state of debilitation to become infected, what chance has the organism of gaining entrance through a tight sphincter-muscle opening, particularly in a hand-milked herd and with a non-motile streptococcus? With milking-machines there is very possibly a tendency, especially when the pressure is in the vicinity of 17 lb., for a slight back-suction into the teat to take place, and if this occurs one can understand why machines are so great a danger where mastitis exists in a herd. Experimentally this point is difficult to prove, though at the first opportunity a trial will be made. With high machine pressure it is known that quite a number of cases may result in a herd. Frequently the Department's officers will hear of some twenty cases occurring overnight when holidays, &c., have caused a careless use of the machines. Friction gives the injury; the streptococci present in the machine from chronic cases provide the organism.

On several occasions tests have been made to induce *Streptococcus lactis* to become pathogenic. Cultures in milk have been injected into the quarter, and when the resultant inflammation takes place a second quarter has been injected with material from the first. The second quarter shows slight inflammation, but the third quarter of the series does not respond, and the streptococcus is found in culture to have died

out. It is evident that the inflammation is set up in such cases from the acid formation of the *Streptococcus lactis* in the milk, and is not due to any toxin produced.

It is remarkable how quickly the udder tissue responds to any change of pH of fluids injected, or to any form of irritant fluid; but as far as can be seen no permanent injury results from such injections unless they break down the secretory cells, even though the saprophytic coccus may be present at the time of injection. This fact rather obliterates the suggestion that saprophytic staphylococci are causative of enzootic mastitis. While acute inflammation exists the coccus almost disappears, but reappears at the first sign of return to health or chronicity of the part. Heavy saline solution, acid solution in the vicinity of a pH of 4.5 (the end point of sugar metabolism by *Streptococcus mastitidis*), and irritant such as weak formalin or ether, all produce a passing inflammation which is not harmful, provided the streptococci are absent. The streptococcus itself will produce a certain amount of toxin, which accumulates in the milk secretion of the udder, but does not cause a clinical reaction in the cow. When the secretion from an acute case of mastitis is filtered through a Seitz filter and reinoculated into a clean quarter intense inflammation results, which again is only temporary. Such a filtrate does not kill an experimental animal such as the guinea-pig or rat, nor cause them inconvenience.

It may be mentioned in passing that *Streptococcus mastitidis* is harmless to human beings in the city milk-supply, and does not, as one frequently hears, cause sore throat epidemics.

(3) Treatment and Prevention.

Although the matter of path of infection is exercising our minds, there is also the question of treatment and prevention, which we are fully conscious of and alive to.

Curative treatment falls into two groups—the one chemical, either local or general; the other immunological, again local or general. In none have we been successful or even partially successful.

Many chemicals were tried by workers before the present team began work in New Zealand; those recently used were as follows:—

General—

Per mouth	{ Potassium iodide. Formalin.
Intravenously	

Local—

Into udder sinuses	..	..	..	{	Brilliant green.
					Acriflavine.
					Ether.
					Formalin.
					Ether-formalin mixture.
Intraparenchymatously	..	..	..	{	Selectan.
					Selectan.

Immunological methods were tried in New Zealand in pre-war days by Mr. H. A. Reid, and consisted of the use of vaccine, and vaccine and sera combined. No beneficial results were obtained. Over the past three years individuals in several herds have been given treatments with vaccine made from autogenous strains of organisms, but

no curative results have been obtained, either with mixed staphylococci and streptococci or with streptococci alone.

A trial was also given Besredka's filtrate in several cases of acute mastitis. In this method the washing from the cells is said to contain a material inhibitive to streptococcal growth, and the filtrate is used in local injections or on pads in local infection in human work. Results, however, were entirely negative.

The prevention of mastitis is also difficult. The recent finding, mentioned earlier in this paper, that so many cows in dairy herds are affected, makes it practically impossible to dispose of those affected and retain clean animals as one would like to do. Until recently the cows at Wallaceville have never developed mastitis naturally, but within the last month two second-calf cows have shown infection in one and two quarters respectively. It may be that in this case a change of milkers has brought this about, and as some of the recent assistants have been inexperienced and heavy-handed men one might assume injury from that fact. The organism has been present for years in certain quarters of many of the cows, having been introduced experimentally into the animals, but no effort has been made to segregate those affected. At the time of writing this paper abortion was not known to be present in the young cattle, but since then cultural work has shown that one of these heifers with leucocytes in the quarters shows only staphylococci in culture and no streptococci. Also, she now reacts to the abortion test, and an effort is being made to find whether *Bacillus abortus* is the causative organism in the mastitis or whether the staphylococcus is the original culprit. It would be unwise to generalize on this case, and the results of further work are now being awaited.

Segregation of animals showing subacute or acute infection is possible and helpful. Such is being attempted on farms where the farmer is willing or can split his herd, and with the elimination of affected cows, which often, inadvertently perhaps, were placed on machines, there has been a marked diminution in fresh cases. Hygienic sheds and apparatus are matters of common-sense and need not be discussed here.

Vaccination.

The question of vaccination must be somewhat specially dealt with in view of the extensive use of this material by private concerns throughout the country. Previous experiments in which vaccinated cows were submitted to infection by the only means in our power—that of udder inoculation with culture or secretion—did not, in our opinion, show that the vaccine was of value as a prophylactic. Data have since been collected over a number of herds vaccinated with herd-autogenous streptococcus vaccines killed with formalin or with heat, and they show absolutely no change between the vaccinated and control groups in the herd. A method of tabulating samples from such herds has been built up as follows: The cases are shown by microscopical examination to contain leucocytes in amounts L_1 , L_1 , L_1+ , L_2 , L_2+ , or L_3 —that is, from chronic by grades to acute. Figures from 1 to 6 have been given these amounts, so that L_1 equals 1 and L_3 equals 6. Then by counting the vaccinated and control cows in each herd and making a percentage of infection against possible normality—for

example, three at L_3 , five at L_{1+} , six at L_1 , in twenty-eight cows gives $(3 \times 6) (5 \times 3) (6 \times 2) =$ forty-five in a possible of $(28 \times 6) = 168$.
 $\left(\frac{45}{168} \times 100\right) = 26$ per cent of infection.

By this means the following figures have been evolved from five of the herds under trial following four examinations of the samples—the first examination before vaccination, the others during or following vaccination.

Vaccinated animals, 155 head.			Controls, 64 head.	
			Vaccinated. Per Cent. Mastitis.	Control. Per Cent. Mastitis.
First examination	..	..	15.5	15.6
Second examination	..	..	21.6*	18.8
Third examination	..	..	14.4	13.3
Fourth examination	..	..	18.7	17.5

* A slight rise after vaccination.

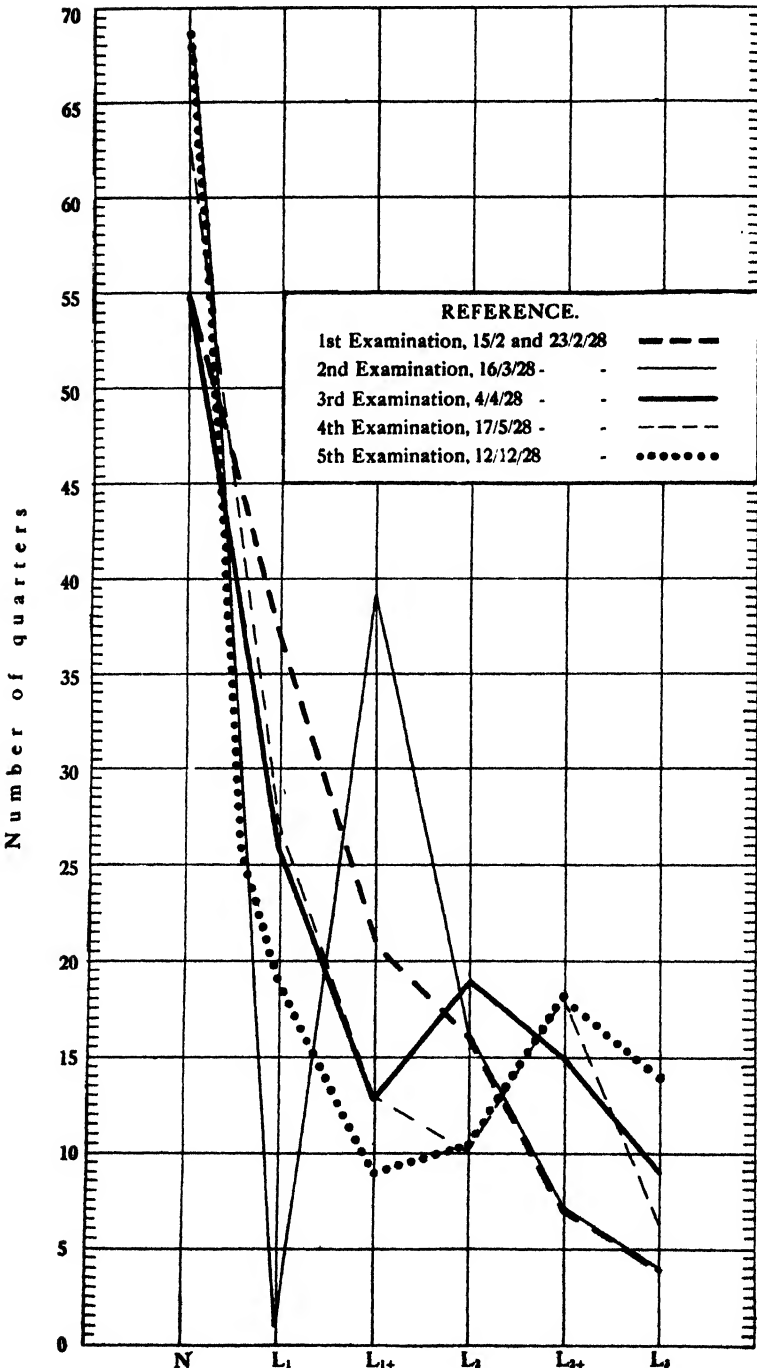
A point of interest is the rise in the fourth reading, which was due to bad weather conditions that arose prior to the taking of the samples of milk.

Examination will, of course, continue over two seasons. In two vaccinated herds they have continued intermittently for two years already, but, we claim, with no results.

Many opportunities for watching herds vaccinated by private concerns have not been taken advantage of, in view of the reports received from a large number of our field officers as to the inefficiency of the vaccine in different districts. One particular herd, however, was watched with considerable interest because of our long association with it. The percentages are striking, and are drawn by the same method of computing the results as previously mentioned. Each quarter of the thirty-eight cows has been examined five times, commencing at vaccination and carried on since February, 1928, at intervals as follows: February, March, April, May, and December—at which latter date all the cows were in full milk once more. It may also be stated here that the cows were repeatedly inoculated about the third examination, and later because of the unsatisfactory state of the herd.

The five examination figures showing the percentages of mastitis are as follows: 15/2/28, 31.2 per cent. (at time of vaccination); 16/3/28, 30 per cent.; 4/4/28, 36.7 per cent.; 17/5/28, 31.1 per cent.; 12/12/28, 41.7 per cent. (See graph, next page.) From both groups of the above figures it is therefore impossible to claim improvement. The latter herd had no control animals left for comparison. Prevention, therefore, cannot be sought along those lines unless the vaccination method is radically changed. At present segregation and hygienic precautions are our only stand-by.

Trial was also made of a method of vaccination employed in anthrax—that of cutivaccination with cultures of streptococcus. Injections were made in two cows, with one cow left as a control; then all three were given mastitis by quarter inoculation, but no difference in time of cleaning-up of the inflammation was noticed, nor was mastitis avoided in the vaccinated animals.



GRAPH SHOWING INCIDENCE OF MASTITIS IN VACCINATED HERD.

CONTAGIOUS ABORTION.

Data collected in New Zealand on the disease known as contagious abortion have shown that the endometritis causing the actual abortion in the calf or retention of membranes as common symptoms originated from the action of the organism known as *Bacillus* or *Brucella abortus* (Bang). This organism is at present assuming greater significance in Denmark and the United States of America, because of the number of cases of intermittent fever in man ascribed to its presence in the blood stream. So far no cases have been known in human beings in New Zealand, but the Health Department is keeping in touch with modern findings and is watching for such cases. Curiously enough, all recorded cases have been in men and in non-pregnant women, so that the effect of the organism on the human genital tract is not known. There are cases of abortion due to other organisms, a few cases having been known due to a streptococcus, but these are in a decided minority. Also some are due to mineral deficiency, such as iron deficiency in the Mamaku area, and unrelated to bacterial invasion.

In one of our large dairying districts where careful observations have been made the disease is present to the extent of 4.1 per cent. in herd cows, but 11 per cent. in first calvers. There is evidence to show that first calvers at two years of age are more subject to abortion than first calvers at three years of age. Also that in good limestone country there is less of this disease than on lime-deficient farms. Whether, as in mastitis, this has a bearing on the reaction of the tissue to the organism resulting in different types has still to be worked out, but the suggestion was made in England recently that such was a possibility. The predilection of the organism is for the pregnant uterus and lactating udder, but no information has been found dealing with the pH of these organs compared with the rest of the body tissues. One would expect, however, that there would be in the pregnant uterus a decided acid reaction due to foetal metabolism, more particularly at the cotyledons, where the disease organism attacks most heavily. Abortion occurs more often in the later months of pregnancy, too, which may have a bearing on the theory that the reason for the persistence of the organism in the uterus at pregnancy is because of the optimum conditions of that organ in acid requirements for *Bacillus abortus*. (Since writing that I have come across an article by an American group of workers showing that a decided increase in CO₂ is present in those two organs.)

One of the problems exercising us at present is the mode of entry of *Bacillus abortus*. It has long been recognized that contaminated pastures are a source of danger, the organism being able to attack animals after injection. Is there, however, a possibility of the bacilli gaining entrance by other ways? Recent experiments at Wallaceville show that the organism injected into the udder will set up acute mastitis, which lasts several days only but sets up an agglutination reaction in the cow. Such a reaction lasts at least three months, but it has not been decided whether actual abortion occurs as a result of this invasion of the udder. The cow affected is five months in calf. Will she abort? Two days ago the seal of the os cervix was obviously degenerating, and we confidently expect abortion within the fortnight.

Another means by which infection may possibly be set up is by the bull. This at present is very much doubted by workers on the subject. At the present time one of our Laboratory bulls has been given an intravenous injection and shows a decided reaction. This bull is now being used with seven known clean heifers to find whether the disease may be transmitted by copulation. Two heifers out of the three served in December have already given a marked positive reaction to both the intradermal and agglutination tests.

Diagnostic Methods in Control.

Diagnostic methods play a very great part in control of abortion. Such methods must be accurate, because many dairy-farmers employ repeated tests to eradicate the disease and keep their herds clean. The test used at Wallaceville is that known as the macroscopical agglutination test, applied to blood serum taken from individual cows. Such a test shows a large percentage of reaction in nearly every herd tested, but not all such cases abort. Data are being collected to show just what percentage of abortion can be expected in cows reacting. Another point of interest in data collected from reacting herds is the fact that about 1 per cent. of heifers pick up or retain infection and react to the test before pregnancy occurs. This percentage, however, is small, and differs remarkably in herds.

The macroscopical test takes twenty-four hours to carry out in its entirety, and therefore attempts have been made to utilize a rapid slide agglutination test which takes two to five minutes. Considerable experience is required, but over a large number of bloods we have shown that the test is slightly more delicate than the longer method; it does not, however, in our experimental work give the highest results which we require. Before Christmas last a test called the double intradermal test—employed in testing cattle for tuberculosis—was applied for abortion, and, from the results obtained in the herd, the test is sufficiently satisfactory to try under field conditions, in fact, the suggestion is that it is even more delicate than the agglutination tests. The drawback in field-work is the necessity for repeated visits of the veterinarian and the keeping of accurate skin-measurements during the test.

Recently a field test known as Bevan's abortoscope has been tried, but in our New Zealand climate the temperature is not high enough to allow the use of this test without an incubator. However, a modification of the test may be useful. Modification gave results in half an hour, but the reading did not appear as easy as with other methods.

It has been claimed in America that mastitis and abortion are correlated, but our New Zealand statistics do not prove this point, and we claim our results to be definite and correct so far as the agglutination test of blood-samples and microscopical examination of milk-samples can correlate the two diseases. Yet from one isolated case, in a heifer at Wallaceville (previously mentioned), we feel that there may be a relationship in occasional cases, and on that account we cannot be completely dogmatic.

Preventive Treatment.

Curative treatment for animals considered about to abort has not been attempted. The position of the organism as it exists in the

lesion in the udder and uterus makes the action of any drug on the organism impossible. Therefore reliance has to be placed on preventive measures. For over two years the Wallaceville Laboratory farm has been divided into two parts—one side running affected stock, the other running clean heifers born on the place from affected animals, but segregated and tested frequently to ensure their remaining clean. They have now calved twice, and neither abortion nor agglutination reaction has occurred among them. It is on these heifers that the infected bull is being given service. This method of dividing a farm is, then, a possibility where the farm lends itself to cutting up. One shed only is required, but two holding-yards, and the only precautions to take are to milk clean animals first, to see that the two herds do not mix, and to use separate bulls.

My latest returns, showing that three of these heifers have very recently indicated abortion, do not conflict with the statement that herds can be kept clean by segregation of infected animals. They do show that the bull is carrying abortion to the heifers. Two of the heifers had been served early in December and a third not until after the reaction had shown up. An explanation is required in the third case. Owing to error the services had not in all cases been performed on neutral ground, and in three instances the bull had run overnight with the heifers. It is a possibility that the heifer which showed a reaction may have been served with one of the others unnoticed, and this possibility is quite a sane one in that the heifer was noticed on one occasion to have a discharge on the tail, suggesting œstrum somewhere about six weeks after calving; and because she calved at the 276th day she would probably return to the bull, making the known service on 12th January her second acceptance. Even though unserved, there is every chance of her having picked up infection from the pasture from the bull's seminal discharge, if he is capable of transmitting the organism to the heifers.

Many countries have used one or another sort of vaccination for the purpose of preventing the disease. In England an extensive trial was given for some years to a vaccine made of live germs injected into the cows. The estimated lessening of abortion was only about 5 per cent. at the most, while the number of carriers made by this method was greatly increased. Dead vaccines were considered useless; nevertheless a vaccine made by killing the organism with chloroform was tried in Rhodesia, and claims were made that abortion was much reduced in native cattle. This method, being harmless, was given a trial in New Zealand last year in heifers, and, because of possibilities of errors in methods of inoculation, repeated this season. Figures and results are as follows for last year, and totals have been reduced considerably where herds were not kept as required by the experimental conditions imposed:—

Taranaki.

205 vaccinated heifers: slipped, 23 = 11·2 per cent.
442 controlled heifers: slipped, 38 = 8·6 per cent.

Wairarapa.

149 vaccinated heifers: slipped, 4 = 2·7 per cent.
29 controlled heifers: no slip.

A number of farmers are at present using lime in larger quantities, particularly in the water-troughs, but it is too early to ascertain whether the treatment is actually effective. A note is being made of the incidence of the disease where such methods are employed. As *Bacillus abortus* is an inhabitant of the udder during pregnancy, it remains for a cure to be found for both it and mastitis together.

We in New Zealand believe that there is considerable so-called herd immunity to abortion, and that after years of this disease in the herds the majority of older animals remain immune after their heifer days. This herd immunity probably arises from the udder infection, and is not a passive but an active immunity, and such immune cows are therefore dangerous to their pregnant daughters.

TEMPORARY STERILITY.

This problem, in which numbers of herds throughout the country contain a varying proportion of individuals which fail to conceive from the first two services, is causing far greater concern than other diseases which we know are infectious and contagious and which the causative organism is known. In temporary sterility there are many factors to be taken into consideration and many lines to work upon—so much so that we find our present team in no way adequate to carry out the necessary work as fully as we should like.

The condition, briefly put, is this: In the first year a large proportion of the cows of a herd return after the first service, which is usually allowed in October. Some cows, however, hold, which rules out total impotence of the bull. A large proportion of the affected cows continue returning regularly or irregularly, but will finally get in calf, often as late as in January or February. Many of these cows are slaughtered, and some are kept over the season and milked the following winter. At their first service in the following spring they hold. In an affected herd the second year finds many of the cows calving late—October, November, and December. The first œstrum following calving appears quickly, and the bull is allowed to mate. Such a service is usually unsuccessful, and we find a repetition of the first year's experience. In such cases quite a considerable proportion of these cows fail to hold for some months, but if held over will easily be got in calf. Therefore one is inclined to say that a genital rest is required. As the condition has been getting more prevalent for the last fifteen years and the average butterfat-production has also increased during those years, one is also inclined to hold that sterility is physiological and caused by greater development of the lactating function to the detriment of reproduction.

The question then arises, How could this occur? Is there an upset of balance among the endocrine glands, or has a mineral deficiency taken place due to the great quantities of lime and phosphate required to produce both milk and calf? As dairy herds in other countries are similarly affected, though largely fed on concentrates, we are rather inclined to think that diet is not the most general factor. However, work is being conducted on both the lines of research mentioned.

(1) ~~With~~ ^{With} minerals: Four farms have been top-dressed with lime and the necessary controls left for experimental purposes; in addition to

this, herds are being *fed* on minerals. (2) With endocrine extracts : Anterior pituitary lobe to increase the activity of the ovary ; follicular fluid to increase the tone of the uterus for the attachment of the fertilized ovum ; and in cases where α -strum is irregular but early the use of extract of corpus luteum.

In Denmark and in America it is the opinion of veterinarians that the condition is due to endometritis. Several reasons present themselves on the negative side, the first being the fact that on examination of many hundreds of cows at meat-works, following cull-cow drives in New Zealand, practically none of the animals showed endometritis or salpingitis. They did in many cases show cervicitis where the first fold is extruded through the cervical os, and many cows showed a cystic condition of the corpus luteum. Both these conditions might possibly be a result of endometritis, and possibly the original condition had disappeared, leaving the secondaries in its wake. But we have found all cystic corpora sterile, and have not found any one organism consistently present in the inflamed cervix. Another reason on the negative side is the fact that possibly 90 per cent. of affected cows return after first service, following what was considered by the farmer to be a perfectly normal calving. Analysis of calving figures, however, shows that in a large number of such cases the calving is a few days early. This fact is at present being demonstrated in heifers at Wallaceville. Three of the animals calved after 278, 276, and 274 days gestation. The other three calved at 283, 283, and 285 days. Two of the short-time group have returned more than once to the bull, while in the second group two have not returned. The remaining two have not yet had time to show up one way or the other.

This in itself suggests an endometritis present during gestation, but may also be physiological, due to an ovarian excess stimulation. That the endometritis if present is not due to *Bacillus abortus* has been amply proved over a series of several hundred cows. Should the condition be endometritis, to what organism is it due? Uterine and vaginal discharges have been examined from many cases, but no consistent growth of any one organism has been obtained. There is often a streptococcic infection of the cervix and vagina in cows, and a streptococcus of the alpha hæmolytic type has been isolated frequently, but numbers of varieties of this type appear. A cow was slaughtered at the Laboratory farm a week ago after returning to a third service, but bacteriologically nothing could be found which could be suspected. Histological results are not yet available, but macroscopically the uterus, tubes, and ovaries were normal. The cervix was slightly flushed and showed a minute flake of pus at the second fold, but as nothing but sporulating aerobes were found one cannot blame that portion of the genital organ. Ovulation had occurred normally, and a normal corpus luteum was being formed. The pH of the organs was also normal, giving a blue reaction to brom cresol purple papers.

Very serious consideration is being given to the position of the bull in sterility. Examination is now consistently made of the seminal fluid for its sperm content and for a possible flora. Clinical evidence frequently supports the theory that the bull is the chief infective agent, but if endometritis is present before calving we are examining the wrong bull or the right bull in the wrong season.

The secondary conditions confuse the issue in the investigation of this disease. Granular vaginitis and vesicular vaginitis, for the treatment of which a number of preparations are placed on the market, are in no way connected with the trouble. They may aggravate it when present, and should be treated where a catarrhal state exists. There are occasions, too, where impotence in the bull is the fault, but such cases are not general. Also, where heifers fail to conceive for their first calf one frequently finds not temporary but permanent sterility, due to cystic oviducts. Some suspicion attaches to the bull where a number of such heifers are found on one farm, but there remains the hereditary tendency to genital defect—a side which it is hoped to develop from the mass of data being collected wherever possible in the field.

Our principal experimental work lies then in--

(1) Collection of all data for sifting in the light of further knowledge.

(2) Bacteriological and histopathological work in bulls and cows, at calving and before service.

(3) Experimental infection of animals when suitable suspected organisms are isolated.

(4) A judicious use of post-mortem examination.

(5) Trial of drugs and endocrine extracts for specific effects on various organs.

(6) Experimental use of minerals.

(7) Chemical analysis of pastures. This work has only recently been commenced, and the few results to hand show an adequate supply of lime but a *low* phosphate content. Where the phosphate content drops to 0.20–0.24 per cent. P_2O_5 , we find a total retention of the corpus luteum, due to inactivity of the ovary and to a total lack of oestrus. Such cows are affected with Waihi disease or aphosphorosis. Where the phosphorus reaches 0.6 per cent., however, the ovaries act normally, and cows may or may not be affected by the temporary sterility.

Where analysis will not help us is in connection with the vitamin content of pastures. The recently found vitamin E may have a distinct bearing on temporary sterility. The absence of vitamin E does not inhibit conception, but causes the death of the foetus at varying intervals, which have not been worked out in larger animals than the rat. What we may have to consider, however, is not the lack of vitamin E, but the too great quantity of the material in the pasture. Vitamin E exists in the green luscious pastures, and it is in this state that the pasture is eaten by cows when the trouble is rife. As the grass dries and becomes shorter, then the cows conceive. That vitamin in excess as well as in too small quantity may have a bearing on disease is suggested by German workers, in particular where vitamins A and D have been used; so that although the possibilities of excess of E are not actually grave, yet every theoretical avenue must be explored practically.

At this stage no exact and specific treatment can be suggested for general use by the farmer, for the etiology is entirely unknown and a matter for conjecture only. Experimental treatment has been undertaken widely with very mixed results.

In early years much general washing out with a variety of stimulating, antiseptic, or astringent chemicals was tried regularly, but the irritation to which the cows were subjected sometimes became an act of cruelty. Later specific washing with drugs for special effects was tried, more particularly to reduce the inflammatory state of granules in a number of the cows where granular vaginitis occurred as a secondary characteristic, or to reduce the cervicitis found present very generally in such cases. One point noticed in connection with such washing was the intense straining caused by mild solutions, and this could only have been due to the action of the fluid on the inflamed anterior vagina. Another point of interest noted at this time in the handling of cows was the fact that on going through a herd it was possible by the state of turgidity of the lips of the vulva to say with considerable degree of accuracy which cows were in calf, provided they were three weeks in gestation and not more than some nine weeks. This point was verified by three field veterinarians.

Recently washing was superseded by swabbing of the inflamed cervix through a speculum with soothing chemical agents, and at times some degree of benefit appeared to be derived by this treatment. However, results were not sufficiently good to make the method general. A number of farmers and some veterinarians now attempt a simple method of treatment which has been in vogue for a considerable time and at times seems to be effective. That method is the pushing of a finger into the cervical os in order to clean out the plug of mucus which occasionally lodges at the entrance. This mucoid material is likely to form with any inflammation of the cervical canal. A similar method is in use in human medicine by instrumentation, and beneficial results have been often obtained even though nothing abnormal could be found in the cervix. Apparently stimulation alone may be useful.

The latest method is that practised by Professor Neilsen in Denmark, consisting in the passing of a catheter into the uterus for irrigation purposes, and this method is now under trial here. In the hands of a skilled veterinarian there is some risk of passing the catheter through the uterine wall, so that the method will not become a general one for use by farmers; but it is required in order to ascertain whether we are dealing with an endometritis, or at the least some inflammatory state of the cervical canal which will respond to such treatment. Late advice from the field is that, although a number of cows have been tried, results do not appear satisfactory; but in the hands of a second field veterinarian results in eight hundred cases are said to be hopeful.

Properties of Superphosphate in Plant Husbandry.—Discussing papers presented at the recent Washington International Soil Congress in the *Journal of Science*, Mr. T. Rigg remarks: "In a paper dealing with the growth of lucerne on acid soils it was shown that, in the particular cases examined, manuring with phosphate did not increase the percentage of phosphate in the lucerne-plants. In view of the well-known response of pastures, lucerne, and other crops in New Zealand to superphosphate, it is most important that careful study should be made of the exact part played by phosphorus, sulphur, and calcium, which are all contained in superphosphate, on both yield and quality of New Zealand crops. It does seem possible that in a number of cases greater benefit has been ascribed to the phosphate contained in superphosphate than actually occurs. Several workers both in California and in Tennessee pointed out the importance of small traces of such chemical elements as boron, manganese, and copper in plant-nutrition. . . ."

FARMING PROBLEMS IN CANTERBURY.

CURRENT RESEARCH WORK OF THE FIELDS DIVISION.

A. H. COCKAYNE, Director, Fields Division, Department of Agriculture.

APART from general instructions and advice on better farming methods, the Fields Division is carrying out a large volume of research and investigation work on farming problems in Canterbury. For practical purposes this work can be divided into four main divisions as follows :—

- (1) The most profitable manuring for grain, fodder, and potato crops.
- (2) The demarcation of soil and pasture types on which top-dressing is likely to be payable.
- (3) The elimination of diseases and pests in grain and other crops.
- (4) Improvement in crop-production by the utilization of superior types, and by means of crop certification.

Improvements in Manuring of Crops.

WHEAT.

Manurial work with wheat is now in its fifth year, and with increase in opportunity the operations this season have expanded considerably. There are twenty-seven series of experiments on farms in Canterbury and North Otago. In each various forms and quantities of phosphate are included. The main objective is to determine what phosphate and what amount is most profitable to use, leading, with an extension of the present programme, to the demarcation of the high and low phosphate-response soils as they exist over the wheat belt.

From the experiments conducted up to the present it has been shown that 1 cwt. of superphosphate on the average increases the wheat-yield from 4 to 5 bushels per acre, and is in general highly payable, but that there are areas where no significant increase can be recorded. The most important result from the work has been the demonstration that high phosphate-response is just as regular on the 60- to 70-bushel crop as it is on the 25- to 30-bushel yield; also that high response is likely to occur equally whether the prior crop has been a harvested one, a fed-off green crop, or roots. Before work was commenced in Canterbury, wheat after rape was rarely manured, yet many of our most significant increases have been secured where the prior crop was of this type.

One of the main difficulties against a rapid extension of this important work is the problem of the harvesting of a very large number of plots. The cereal investigation projects that have been laid down this season necessitate the separate harvesting and weighing of over six thousand plots, and in order to secure efficiency adequate apparatus is necessary. In past years a small mill driven by a tractor has been used, but this season a special easily transported threshing unit has been devised that will enable all the plots to be harvested accurately and expeditiously.

Until quite recently it was not considered that nitrogen in increasing the yield of wheat was likely to be profitable, but the work under this project has shown that nitrogen top-dressing in the spring, in addition to phosphate application at the time of sowing, is likely to be a sound manurial practice. Last season over a number of trials nitrogen in the form of nitrate of soda at the rate of 1 cwt. per acre increased the wheat-yield by 6 to 7 bushels per acre over and above the 4- to 5-bushel increase secured through phosphate. This season some twenty-five carefully conducted experiments with nitrogen are being carried out, and in addition some three hundred demonstration areas have been top-dressed. Experiments also as to the relative effects of various types of nitrogen have been laid down.

If this season's results again demonstrate that nitrogen top-dressing is likely to be highly payable, experiments on amounts, kinds, and time of application will have to be undertaken. The fact that in a great number of instances phosphate-manured wheat has in the spring the typically pale coloration indicating nitrogen starvation is being taken by the Division as a pretty clear indication that top-dressing such crops with nitrogen would be a payable practice. An element of uncertainty lies in the fact that extensive nitrogen work with wheat has been largely confined to the past two seasons, both of which may have been particularly favourable to nitrogen response. However, the fact that for three seasons in succession payable increases have been recorded on one particular farm would seem to indicate that seasonal factors were not the definite cause of high response.

TURNIPS.

In the drier parts of New Zealand super has been shown to be the best phosphate for turnips up to 1 cwt. per acre. Above this amount its solubility is apparently disadvantageous, and its depressing effect on germination serious. The standard Canterbury dressing of 1 cwt. per acre has been shown to reduce germination by some 20 per cent., and 2 cwt. per acre reduces it by over 50 per cent. This refers particularly to Canterbury, where one-third of our turnip crop is grown, but germination injury is common throughout. Bad effects on growth always follow germination injury. The methods under trial to overcome injury are (1) pre-drilling portion of the manure, (2) post-drilling portion of the manure, (3) reversion of the super by mixing it with lime.

The use of lime with super has increased the germination in certain cases by 50 per cent., and the yield by 20 per cent. in some instances. Much requires to be learnt regarding the amounts of lime to use and when it should be mixed. Mr. W. D. Reid, in connection with his legume nodule organism work, is working out a clever method of testing the injurious effects of manure, using the nodule organism as the indicator.* This will enable a drastic reduction to be made in the number of treatments necessary to test in the field.

Methods whereby heavier applications of phosphate may be safely used will be of the very greatest value throughout the whole of

* See article by Mr. Reid describing an experiment with lucerne-seed, page 103 of this issue.—ED.

Canterbury, and this work can perhaps be viewed as being one more pregnant with immediate possibility than almost any other undertaken.

RAPE.

Four years' work in Canterbury with phosphate has definitely shown that the slow-acting phosphates by themselves are definitely inferior, but when used in combination with super the results are far superior to where super alone is used. Nitrogen has increased the crop by 25 per cent., being payable on good crops, but not so on poor ones. A large number of trials are being conducted this season.

POTATOES, ETC.

The work carried out indicates that increases of from 1 to 2½ tons of table potatoes are secured with 3 cwt. of super; in fact, the manuring of the potato crop is the operation which shows the greatest profit, and at the present time it is the one that is most neglected in this respect.

So far as other annually sown harvested crops are concerned, such as barley, oats, peas, linseed, &c., no properly planned work has so far been attempted.

INCIDENCE OF MANURING.

In order to secure fairly reliable information regarding the amount and incidence of cereal and other crop manuring (information of great value in planning experimental location) it was arranged with the Government Statistician for such information to be included in the "acreage sown" cards that he sends out each spring. The results of this collection are of distinct interest. Of the 200,000 acres of wheat in Canterbury this season some 130,000 acres have been manured. Out of 130,000 acres of oats, 75,000 acres have been manured, and out of 11,000 acres of potatoes less than half—namely, 5,000 acres—have had manure applied. These figures indicate that the Canterbury farmer is by no means taking full advantage of the profit resulting from rational manuring, and show the necessity for extended demonstration. It is safe, however, to say that the comparatively large areas of cereal crops which have been manured are a direct reflection of the extended experimental work that the Division has carried out.

Demarcation of Soils and Pasture Types on which Top-dressing Response is likely to be payable.

Some two hundred distinct top-dressing trials to be carried out over a series of years were laid down during last season, and these should give extremely valuable information. Owing to the small response from top-dressing on much Canterbury land, renewal of pastures to keep up an adequate supply of young and vigorously growing grass will have to remain on such land an integral feature of management. But it is essential to find out on what soils and under what conditions top-dressing will enable grassland to remain essentially young in character longer than at present. In many cases at present pastures are old and useless for rapid milk- or meat-production at the end of the third year or earlier. Where top-dressing is payable the tendency must be to extend the profitable life of pastures, but where it is not so an increase of cropping leading to more rapid renewal of grassland

would appear sound. At the present time less than 1 per cent. of the sown grassland of Canterbury is top-dressed. This is in striking contrast to the 85 per cent. that is annually top-dressed in Matamata County, in the North Island. Phosphate responses in parts of Canterbury are highly satisfactory, but in others they are not payable, and the work now being undertaken should enable the Division to say with far more assurance than at present when and where top-dressing should become a regular practice.

Elimination of Diseases and Pests in Grain and other Crops.

Perhaps the most significant achievement of the Fields Division in the past five years has been the brilliant work of Dr. G. H. Cunningham in demonstrating that a large number of our most serious crop-diseases are seed-borne, indicating the importance of using seed that is free from disease. A very great deal of work has been and is being conducted along the line of seed-treatment, and with regard to the barley crop several serious diseases have been more or less eliminated from considerable areas of New Zealand. The control of seed-borne diseases represents the major line of attack that is being made by the mycological specialists of the Division, and this is very closely connected with certain phases of crop certification, the final objective being an adequate supply of disease-free seed to be made available for all farmers.

Another line of research that is being actively prosecuted at the present time is the control of certain insect pests, notably turnip-aphis and diamond-back moth, both of which seriously limit the optimum production of the turnip and rape crops in Canterbury. Here biological control by the use of natural enemies appears to be the most hopeful line of action, and a thorough study of all known natural enemies is being made by the entomological staff of the Division.

Superior Types and Crop Certification.

The Agronomist in charge of this work is using the method of crop certification as the basis on which the whole of the work finally hinges. The final objective of certification is to enable farmers to secure reliable seed true to type and disease-free. It is not to be expected that strains absolutely true to type and free from disease can be made available immediately; but this is no reason why crop certification should not be put immediately into operation, enabling the hall-marking of the reasonably pure and reasonably disease-free crops as against what may be termed the "scrub" crops of the country. Ability on the part of the farmer to secure "certified" seed representative of the best crops in the country, rather than perhaps the worst, will be of enormous advantage. The very considerable success already following the initial work in potato and wheat certification has shown conclusively that crop certification is as important in crop-production as herd-testing is in milk-production.

Certification of crops as they exist can be put into operation just as fast as it is known what characteristics should be certified to, and whether the certification of certain characteristics is a reliable guide

to the superior qualities of any crop. In the securing of such knowledge an immense amount of work is involved—in strain selection, experimental and field testing, ascertaining of disease resistance, disease treatment, and a host of other considerations. At the beginning certain assumptions have had to be made, and these and any further assumptions have to be proved or disproved by accurate trial and investigation. The case of the potato may be taken. It has been assumed that with regard to any particular variety the best crops are those that contain few rogue plants and are freest from disease. Certification so far has been based on this assumption, but there is also the assumption that certain strains within any variety are better than others, and that the presence of certain diseases is far more objectionable than the presence of others. These assumptions have all to be studied, and by the final production of the best types of pure line strains, free from any diseases of moment, it is hoped to achieve great improvement in the crops. Certification is to be used to segregate the better from the poorer crops at present grown, and later on it will also be able to retain the identity of any new strains, or any crops that are free from diseases that are carried in the seed.

Again, there are certain assumptions—particularly true with regard to grasses and clovers—that crops in certain districts and under certain conditions of management produce better types of seed than others. The actual isolation of special types and their thorough testing is a matter that may take many years; but there are some points with regard to certain grasses and clovers which could rapidly be put under certification. The value of such certification could be tested, and if found reasonably sound could continue until such time as definite specially selected and tested strains were available for certification. The following are examples of such types of temporary certification; some are to be put on trial this season: (1) Cocksfoot certified to be from pastures over ten years old; (2) white clover certified to be from pastures over twenty years old; (3) brown-top certified to be free from red-top; (4) red clover certified to be from crops that have been harvested for seed three or more years in succession; (5) red clover certified to be free from dodder; (6) Hawke's Bay rye-grass certified to have been produced in Hawke's Bay or Gisborne.

It is perhaps not generally realized how greatly the agricultural instruction and research work of the Fields Division has increased in Canterbury during the past six years. There is now a staff of eight under the control of Mr. R. McGillivray, Fields Superintendent. In addition, the Agronomist, Mr. J. W. Hadfield, and his staff are located in Canterbury, while much of the work of Mr. A. W. Hudson, Crop Experimentalist, Dr. G. H. Cunningham, Mycologist, Mr. J. C. Neill, Field Mycologist, and other officers of the Plant Research Station of the Division is concerned with research and investigation into problems that are particularly concerned with the future progress of Canterbury agriculture.

Finally, much useful co-operation is being maintained with other bodies or institutions concerned with the agriculture of the province, such as the Canterbury Agricultural College.

HIGH PROTEIN CONTENT OF PASTURE.

RESEARCH ON SUGGESTED RELATION TO DAIRY COW DISEASES.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

ATTENTION having been drawn to the possibility that a ration having a high protein content, such as that furnished by the richest New Zealand pastures, may have a considerable influence in contributing towards the incidence of reproductive troubles in cattle, the matter is now being investigated by the Department of Agriculture. Farmers are asked to assist those officers who are collecting samples for this purpose. The evidence so far gathered shows that this is a line of investigation well worthy of thorough inquiry.

North Island soils are usually well provided with the valuable fertilizing-agent nitrogen, and this is reflected in the better pastures, where extraordinarily high figures for nitrogen, and consequently protein content, have been lately recorded in the lower Wairarapa, Waikato, and Nelson districts, the last by Mr. T. Rigg, of the Cawthron Institute. This would not warrant special mention of the matter if at the same time there were not appearing in New Zealand troubles in stock which may possibly be referred to an excess of nitrogenous constituents in the diet. Many years ago at Waitotara nitrates or nitrites in mangels were held responsible for the deaths of many cattle and pigs when fed on these roots growing in the field (this *Journal*, Vol. 3, page 311, 1911). This will show the high percentage of nitrates which may occur in New Zealand soils under favourable conditions. The pulpy kidney condition in lambs occurring in Central Otago and other districts has been associated with an excessive proportion of amines in the spring grass, and this has been suggested as a cause of the mortality (*Journal*, Vol. 34, page 231, 1927).

Bulletin 417 of the Ohio Agricultural Experiment Station comments on the fact that three experimental cows dieted on the "narrow" ration of 1-2 suffered from temporary sterility, became very thin, and seemed to tire of the ration. The authors say, "Their response to this ration is especially interesting in the light of many complaints which have come to our attention regarding breeding difficulties that seem to attend the use of high protein rations." The ratio 1-2 of digestible protein to non-protein is what is called a very narrow one—that is, the protein is excessively high compared with the non-protein; but it is important to note that some New Zealand pastures provide even a narrower ration than this.

The suggested remedy for this state of things is to widen the ration by giving a feed of much lower protein content, supplementary to the pasture. What is at present required is more information, for the problem of temporary sterility in dairy herds is one of immense importance. If herds which receive summer supplementary feed such as green oats, green maize, turnips, sugar-beet pulp, and maize or other starchy meals low in protein do not suffer, it warrants further inquiry. Woodman (*Journal of Ag. Science*, Vol. 6, page 25, 1926, and *Scot.*

Journal Ag., Vol. II, page 383, 1928) appears to have suggested something similar, and if this is so where the protein content of pastures is not so high as in New Zealand, how much more necessary is it here. He says, "It appears justifiable to assert that optimum results are not possible on closely grazed pasturage with any class of stock—young grazing stock, dairy cattle, and fattening animals alike—unless such animals are receiving, at all stages of the season, some supplementary food which is richer in carbohydrates." He also suggests that carbohydrate supplements might materially mitigate evils, such as scouring in early spring, possibly due to excessive digestible protein.

DAIRY-FARMING ON SECOND-CLASS BUSH- LANDS.

NORTH AUCKLAND SETTLERS' EFFECTIVE WORK IN PASTURE-MAINTENANCE.

C. J. HAMBLYN, B.Ag., Instructor in Agriculture, Whangarei.

THROUGHOUT North Auckland large areas of second- and even third-class bush-lands are used for dairying. The comparatively small holdings of from 100 to 500 acres, together with the generally limited financial resources of the farmers on this type of country, are the two chief reasons for the development of dairying and lamb-raising in preference to dry-stock farming, though in many cases the two are successfully combined. With the rapid falling-off of surface fertility after the first period of profitable grass-production, lasting from four to six years from the initial burn, the opening-up of the sward is followed on the one hand by a replacement of the better grasses by brown-top, danthonia, or paspalum, and on the other by secondary growth of various sorts such as bracken-fern, manuka scrub, &c., the type of reversion depending largely on the original sowing of the burn and the subsequent management. Where the dairy cow is the revenue-producer on the farm the reversion to inferior pastures or to secondary growth means a very definite reduction in carrying-capacity and falling-off of returns, and generally—since sufficient dry stock cannot be maintained—fern and scrub tend to take charge before the slower-establishing grasses can take up the running.

With the extension of the North Auckland railways, together with lower freights, better roads, and cheaper fertilizers, manurial top-dressing is beginning to play an ever-increasing part in the maintenance and improvement of the pastures on these farms. But the outstanding instances of improvement in all these districts are those where the manual labour on the farm has been brought to bear in preparing the way for successful and profitable use of top-dressing and regrassing.

Logging up of the felled bush areas, and cutting of the fern and other growth by hand or machine where possible, followed by burning

off, disking, and harrowing of the easier slopes, and resowing the burnt patches, combined with top-dressing, are the methods used, the only cash expenditure being for the grass-seed and manure. The longer this process is delayed after the first falling-off of pasture-production, the slower and more costly is the renovation; but, realizing that for profitable dairying good pastures are essential, farmers are putting their backs into the work, and so long as the grass is given a chance by the removal of the second-growth shade and the very favourable opportunity for invasion occurring among the rotting stumps and logs, top-dressing, combined with efficient management of pastures with the dairy herd and the young stock available, is proving both profitable and successful in keeping out the objectionable secondary growth.

Viewed as a whole, the second-class bush-lands of North Auckland, where dairying is perforce the main source of revenue, represent a wide range of soil-types, and an even wider range in the stages of reversion reached. Generally it is being more and more clearly recognized that, since the dairy cow unassisted is practically useless in the control of secondary growth and requires good pastures to be profitable, the old methods of cleaning up haphazardly with the fire-stick lead to a dead-end. The practice of thoroughly cleaning up a paddock at a time by manual labour in order to concentrate and control the fire, surface cultivating wherever possible and necessary, reseeding the patches, and top-dressing, followed by subdivision and the better control of stocking, though slow, is giving excellent results. This means not only increased carrying-capacity and returns, but also a marked increase in the farmer's assets represented by good steadily improving pastures, as against the equally steady and inexorable deterioration that goes on where no concentration of effort is made.

As an outstanding example of the results of concentrated effort on the part of a settler in combating the natural tendency of his section to revert to secondary growth, as evidenced by the experience of neighbouring farmers, the following history of a bush section is given. Five hundred acres of second-class bush-land (sandstone country) were taken up in 1920 by two returned soldiers, Messrs. McCullough Bros., at Takahue, near Kaitaia. Forty acres had been felled and sown, and fern and manuka were coming in. By 1923 a total of 180 acres had been felled and sown. No more bush was then cut. During the 1925-26 season thirty-two cows were milked, and extra unprofitable dry stock had to be maintained in an effort to keep down the secondary growth, which was rapidly coming in and just as rapidly reducing the carrying-capacity in dairy cows. In order to increase the carrying-capacity there was a choice of felling more bush (the usual practice) or improving what was already in grass. Realizing that about one-third of the area was unproductive owing to logs and stumps, and that according to the experience of neighbours they were not likely to maintain a material increase in the carrying-capacity in cows by felling more bush, they decided to tackle the problem by logging up and top-dressing.

The standing bush was not likely to deteriorate, and with the advent of a metalled road and a demand for easily accessible timber

it was felt that in the millable rimu, &c., there might yet be a valuable asset which would otherwise be destroyed. Commencing in 1926 and working between milkings, some 30 acres were logged up, the scrub and fern cut and heaped, the patches burnt and sown, and the area top-dressed with basic slag at 4 cwt. per acre. The total cash outlay amounted to £57 for seed and manure landed on the farm. For the season 1926-27 forty cows were milked, giving an increased return of 1,804 lb. of butterfat, or a cash increase, at 1s. 4d. per pound, of £120.



FIG. 1. REVERSION OF BUSH-BURN GRASSLAND TO SECOND GROWTH.

In 1927 another 30 acres were dealt with in the same way, and the first area top-dressed again at the rate of just under 3 cwt. per acre of basic slag. The herd was increased to forty-six, but, owing to the extremely dry season, though the returns to the end of January were over 800 lb. butterfat ahead of the previous season, the final returns were only 36 lb. ahead. This represented an increase of 1,840 lb. butterfat above the 1925-26 season for an extra outlay of £75 in seed and manure.

During 1928 a further 65 acres were cleaned up by the same methods, and top-dressed with 13 tons of basic slag, while an additional area of 15 acres not logged up received $3\frac{1}{2}$ tons of top-dressing. The total expenditure in grass-seed and manure this year was £131 10s., the herd was increased to fifty-five cows, and the returns at the time of writing (20/11/28) were 1,114 lb. of butterfat ahead of the previous season.

The net results of Messrs. McCullough's efforts so far are that of the 500 acres in the section 280 acres are still in bush and definitely increasing in value on account of the millable timber, 125 acres have been cleaned up and top-dressed in the three years and are now carrying fifty-five milking-cows and double the young stock during

practically the whole of the milking season, an additional 15 acres have been top-dressed, and the way is clear for the rapid improvement of the remaining 95 acres, with a consequent increase in the herd, which they hope to build up to between eighty and ninety cows within the next few years. With the start of 6 tons of manure and their labour



FIG. 2. AN UNLOGGED HILLSIDE, FIVE YEARS AFTER FELLING OF BUSH



FIG. 3. ANOTHER SPUR, LOGGED AND TOP-DRESSED WITH BASIC SLAG, FIVE YEARS AFTER FELLING.

[Photos by McCullough Bros

they have been able easily to pay their way, both as regards the purchase of the extra cows required and the grass-seed and manures used.

A very important feature of the subsequent management of the pastures is the development of annual top-dressing and further subdivision, together with, wherever possible, tripod harrowing of the paddocks, and above all an efficient system of grazing in order to keep in check the tendency for fern to come in. In this connection Messrs. McCullough favour paddocks of about 15 acres. The cows follow a definite rotation of from two to three days and nights in each paddock; the young stock are used immediately behind the milking cows to clean up, and each paddock is spelled for at least two weeks before the next grazing-period. In this way the cows get the best of the grazing, the dry stock do the cleaning-up, the pasture is periodically spelled, and a close sward is maintained. No doubt with the development (as soon as the work of cleaning up is completed) of annual top-dressing and regular tripod harrowing it will be found that the size of the paddocks can be reduced, and the management problem so far as fern invasion is concerned materially lessened.

It is often argued that the cost of logging up and clearing bush-burns in the early stages is prohibitive. In this case it has been done as part of the work of the farm—an application and utilization of the available manual labour in a particular direction, with no cash outlay but with very desirable results. In the 125 acres dealt with the original burns were from three to seven years old, and portions of the original burn when the farm was taken up were also cleared. The total time occupied in logging up and burning amounted to 310 days of eight hours each, and the time spent in cutting and burning fern and scrub totalled seventy-six days of eight hours each, making a total cost for the 125 acres, at 14s. a day, of £268 16s., or £2 3s. per acre. Where the logging is done thoroughly, as in this case, and the scattered fern, &c., stacked also, the cost of grass-seed works out at 10s. per acre. The basic slag at £4 5s. in Auckland cost £6 per ton landed on the farm, or £1 4s. per acre for a 4-cwt.-per-acre dressing.

Numerous other instances of an application of the methods described in these notes are to be seen throughout North Auckland, and there is every reason to believe that much of the now unprofitable second-class bush country covered in logs, stumps, fern, and scrub will be brought in to profitable dairy pastures by this means.

In conclusion, the writer wishes to record his indebtedness to Messrs. McCullough, who from carefully kept records kindly supplied the figures quoted.

Certificate-of-Record and Official Herd Testing.—The upward trend in number of cows tested under these two systems and number of breeders participating is being maintained. During January, 1929, 665 cows were tested under the C.O.R. system. These were in the ownership of 226 breeders. The corresponding figures for January, 1928, were 186 breeders testing 599 cows. The number of Official Herd Test cows tested during January, 1929, was 1,666, these being in the herds of 128 C.O.R. breeders. This compares with 111 breeders and 1,477 cows for the corresponding month of last year.

SOME EFFECTS OF FERTILIZERS ON THE PRODUCTION OF LUCERNE ROOT NODULES.

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IN the establishment of lucerne it is recognized that the formation of root nodules during the growth of the first season is essential for satisfactory results. In some areas in New Zealand artificial inoculation of the seed or soil is not practised—for example, in Marlborough, Central Otago, and Poverty Bay; but in other districts, where the conditions for the growth of lucerne are not so favourable, inoculation of the seed by cultures, or of the area by infected soil, is considered necessary. In all cases, of course, inoculation is required, but in the three districts first mentioned, the grower (perhaps unknowingly) relies upon sufficient inoculation being obtained from the bacteria already present on the seed or in the soil of the area to be sown down.

For a number of years this Laboratory has been supplying farmers with cultures (on agar slopes) for the inoculation of lucerne-seed, and although the results have been very satisfactory a number of cases have occurred in which nodule-production has been negligible or retarded. These same cultures when used in soil tests at the laboratory have given excellent nodule-formation, and the cause of the failure of the field inoculations required an investigation. The laboratory experiments were at first restricted to sowings in soil, the details of farm procedure being followed as closely as possible. Now, in New Zealand it is the custom to mix the seed with the fertilizer prior to sowing, but this fact was not considered in the first experiments. Instead the fertilizer—superphosphate—was sown in drills and the seed sown upon this manure. The obvious results of these sowings indicated the deleterious effect of superphosphate on the germination of the seed, and it was inferred that a similar effect on the nodule bacteria would be produced. This reduction of germination due to superphosphate is well known to those who have studied the effects of manures, and Mr. A. W. Hudson, Crop Experimentalist, suggested the use of the various manures sown with lucerne-seed, together with one of equal parts of superphosphate and lime, a mixture which had been giving good crop results and little loss in germination in Canterbury.

In order to enable a number of tests to be performed without the delay required for the production of nodules on the plants, plating methods were used, in which the viable bacteria after treatment were allowed to produce visible colonies on agar plates.* To eliminate possible contaminations of the plates by bacteria adhering to the seed, sterilization of the seed was required. The usual method of sterilization by dipping in corrosive sublimate (1-1,000) was unsatisfactory, since

* Mannite-agar to which 0.5 per cent. CaCO_3 is added. F. Lohnis and N. R. Smith, *Jour. Ag. Research*, Vol. 6, No. 18, p. 686.



FIG. 1. DEMONSTRATING THE IMPORTANCE OF INOCULATING LUCERNE.

Portion of stand on Mr. W. H. Talbot's farm, Pleasant Point, South Canterbury, in October last, ten months after sowing. Foreground—untreated seed. plants yellow and stunted. Background—seed treated with laboratory culture. plants vigorous, with good colour.

[Photo by A. W. Hudson]

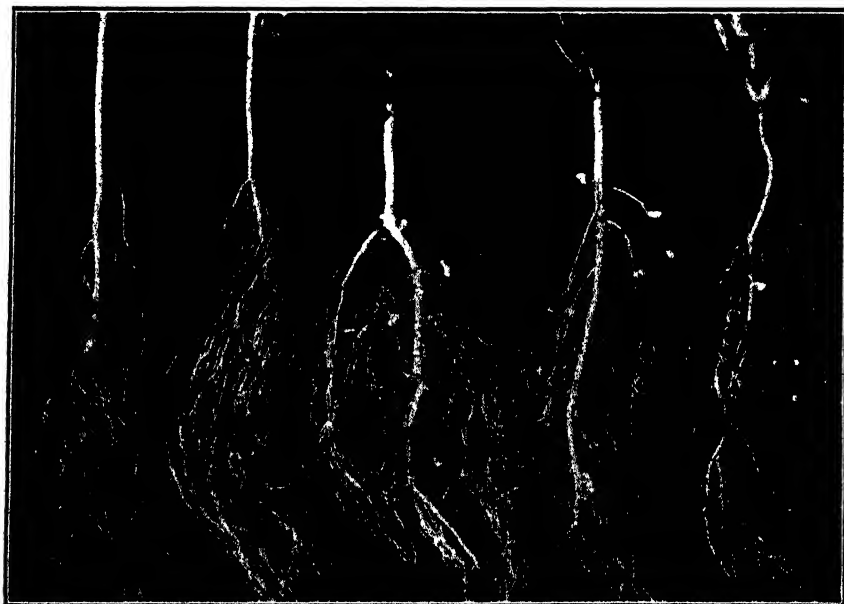


FIG. 2. SHOWING EFFECT OF DIFFERENT FERTILIZERS ON LUCERNE SEED.

The two plants on left are from superphosphate-treated seed; no nodules present on roots. The other three plants are from slag-treated seed; numerous nodules present. All plants approximately two months old.

[Photo by H. Drake.]

this treatment prevented the growth of the bacteria of the subsequent inoculation, but of the many disinfectants tested ethyl alcohol was found satisfactory.*

The following procedure was adopted in the various tests performed :—

(1) A commercial sample of lucerne-seed of good germination was sterilized by the use of ethyl alcohol, washed in sterile water, and dried.

(2) The inoculation of nodule bacteria was applied to the seed, skim-milk being used for the purpose. Under farming conditions drying does not take more than half an hour, but in the laboratory drying between sheets of sterile absorbent paper occupies about one hour.

(3) The inoculated seed was mixed with the manure to be tested and allowed to remain in contact for half an hour. This period agrees approximately with the time which would elapse under field conditions, but in some tests where the seed was left in the manure for as short a time as fifteen minutes the results agreed with those for the longer periods. Although the quantities of seed and manure were used in the same proportions as for field sowings—14 lb. seed and 3 cwt. manure per acre—this proportion was not essential, as the same result is given by a reduction of the manure to a quantity only sufficient to cover the seed.

(4) After leaving the seed and manure in contact for the desired time, each seed was removed, shaken to remove surplus manure, and then placed upon the surface of the agar-medium plate in the petri dish. Ten seeds were placed on each plate of 3½ in. diameter. Alternate seeds were "wiped" over the corresponding sectors of the plate, and the plate was then incubated for at least seven days at 25° C.

The removal of the surplus manure before plating does not agree with the practice of sowing together the manure and seed on the farm, but such a laboratory method was necessary in order to study the comparative colony growth. In all, fourteen tests were carried out during last year, and a typical result is given in the following table :—

Table 1.

Fertilizer.	Time of Contact of Fertilizer prior to Plating.	Number of Seeds sown on Plates.	Number of Seeds producing Colonies.
Control—no manure and no inoculation	..	10	Nil
Control—no manure plus inoculation	..	10	10
Super A	½ hr.	11	4
Super B	½ hr.	11	5
Basic super	½ hr.	10	All
Super plus lime	½ hr.	10	All
Basic slag	½ hr.	10	All

NOTE.—Supers A and B were obtained from different sources of manufacture.

The table gives for each manure the number of seeds which produced colonies of the nodule bacteria. This result in itself is instructive,

* A paper dealing with a study of some methods of sterilization of lucerne-seed will be published elsewhere.

but a study of the number of colonies produced on the "wiped" areas (see photos) supplies a better method of comparing the various effects.

In the case of superphosphate and basic superphosphate the number of colonies which developed on the wiped areas fluctuated between nil and ten colonies for each area, whereas on those plates which received seed which had been treated with slag the number of colonies was indefinite—that is, more than one hundred per area. In these tests the manures were not sterilized, since it was found that,



FIG. 3. AGAR PLATES OF SUPERPHOSPHATE-TREATED SEED, SHOWING LIMITED DEVELOPMENT OF NODULE BACTERIA COLONIES AFTER TREATMENT.



FIG. 4. ON LEFT, BASIC SUPER TREATED, SHOWING THIRTEEN COLONIES; ON RIGHT, SUPER AND LIME TREATED, SHOWING LARGE NUMBER OF COLONIES, PARTICULARLY ON THE TWO UPPER "WIPED" SECTORS.

[Photos by H. Drake.]



FIG. 5. ON LEFT, NAURU PHOSPHATE-TREATED, ON RIGHT, SLAG-TREATED; BOTH SHOWING EXCELLENT DEVELOPMENT OF COLONIES.

[Photo by H. Drake.]

with the exception of fungi in the super-lime mixture, they were sterile, or were free from any bacteria which could produce colonies similar to those of the nodule bacteria.

As is indicated by the photographs, the number of colonies produced increase as the basic nature of the manure is increased. No attempt is made herein to propound any theory to account for the results which have occurred.

In addition to the plate tests, soil tests were also made, utilizing the correct seed and manure quantities. The results have been equally striking, even after allowing three months' growth before examination, as was the case with the example shown in the following table:—

Table 2.

Fertilizer.			Germination on 100 Seeds sown per Box.	Number of Plants with Nodules.	Number of Plants without Nodules.
Superphosphate (A)	..	..	30	2	28
Superphosphate (B)	..	..	25	1	24
Basic superphosphate	..	..	41	2	39
Superphosphate plus lime	..	..	53	26	27
Nauru rock phosphate	..	..	63	50	13
Basic slag	..	..	58	52	6

Although all the soil tests are not so consistent in results as are the plate tests a fair agreement is present, and they at least confirm the general conclusion derived from the plating method. Such factors as amount of milk film, age and condition of manure, source of manure, origin of culture, have not been considered in detail, since these factors are masked by the application of the manures. Similarly in the soil

tests variations must occur in the conditions of sowing, particularly conditions of moisture content of the soil, and it is recognized that variations—even under so-called controlled conditions—must result in repeated tests. Under field conditions success has been obtained by the use of superphosphate manures, but in these instances the manure has not been mixed prior to sowing, but “fed” through a separate box, contact taking place between seed and manure during the passage through the coulter. Since this period of dropping through the coulters is very short it is possible for many of the milk-film protected bacteria to survive.

CONCLUSIONS.

These experiments show that where superphosphate fertilizers are mixed with the inoculated seed before sowing the nodule bacteria are killed; and that where rock phosphate or basic slag is utilized excellent results are obtained.

Since this method of applying cultures to the seed is the most satisfactory for New Zealand conditions, it is advisable to refrain from using the “acid” phosphates, or, where such are the only manures available, to sow the seed and manure separately or through separate boxes of the drill.

THE FIREBLIGHT MENACE.

SEVERE EXPERIENCE IN A HAWKE'S BAY ORCHARD.

N. J. ADAMSON, Orchard Instructor, Hastings.

THAT fireblight is a real menace to our fruitgrowing industry, particularly to the apple export trade, appears not to be fully realized by the majority of orchardists, more particularly those in districts or localities where fireblight does not exist. Notwithstanding the fact that much has been written and related in connection with fireblight, and instances of severe loss and irreparable damage quoted, we still find people who are sceptical and are inclined to the opinion that an unnecessary scare has been raised by the officers of the Horticulture Division. But seeing is believing, and any one, fruitgrower or otherwise, having had the opportunity of witnessing the loss suffered by several orchardists at Poukawa, in Hawke's Bay, this season could not but become a propagandist in the cause of eradication or prevention of fireblight.

A party of orchardists from Nelson (a fireblight-free district) who recently made a tour of the Hawke's Bay fruitgrowing area were afforded an opportunity of visiting one of these Poukawa orchards and seeing for themselves the havoc wrought by the disease, and came away deeply impressed. The particular orchard inspected consists of 13 acres of apples and pears. Pear-trees, numbering six hundred, comprise Winter Cole, Winter Nelis, P. Barry, Beurre Bosc, and Williams Bon Chretien; the apples are mainly Sturmer, Ballarat, Jonathan, and Delicious.

Investigations revealed that odd fireblight infections appeared on pear-trees in the 1927-28 season, some as blossom-infection, but more

as shoot-infections subsequently. Cutting out was resorted to, but evidently the treatment was not sufficiently drastic, and through several infections not being located a number had travelled into heavier timber, remaining as "hold-overs." Although several such cankers were located, and affected branches and limbs cut out and destroyed during the pruning season, some remained and produced the characteristic ooze at a period coinciding with the blossoming this season. Following a severe outbreak in the orchard, more of these hold-over cankers were located, and were discovered to be oozing. Through the orchardist's inexperience in the matter of cutting out infection, and more particularly in seeking out the dangerous hold-overs, wholesale infection occurred throughout the orchard. As a result of this bud-infection the apple crop on most varieties has been practically wiped out, Sturmer and Ballarat suffering almost a 100 per cent. loss, while Delicious may have a 30 per cent. crop left. Strangely enough, this proportion of loss does not always apply, as the writer has known of instances where Delicious suffered a total loss while Sturmer trees carried a fair crop. Apparently the proportion of loss in any particular variety is light or heavy according to its receptiveness at the time when other conditions for the spread of fireblight are present.

The loss of the apple crop, although severe in itself, is not the only loss as far as the apples are concerned. Owing to the killing of the fruit-buds and spurs only a 50-per-cent. crop can be expected next year,



FIG. 1 (LEFT). BEURRE BOSC PEAR-TREES WITH DISEASED LIMBS REMOVED—
TYPICAL OF WHOLE BLOCK IN THE POUKAWA ORCHARD.

FIG. 2 (RIGHT). REMAINS OF A WILLIAMS BON CHRETIEN PEAR-TREE DESTROYED
BY FIREBLIGHT.

[Photos by N. J. Adamson.]



FIG. 3. BUD INFECTION OF FIREBLIGHT ON APPLE SHOOT—TYPICAL OF EVERY PORTION OF STURMERS IN THE ORCHARD.

[Photo by H. J. Lovell-Smith.]

even if further bud-infection does not occur. That means only one half-crop in two years, and the chance of a repetition of this experience if precautions are not taken. Owing to the killing of the buds and loss of foliage, the trees received a setback early in the season. A good growing season, helped of course by the absence of fruit, has enabled the apple-trees to make a wonderful recovery. No severe damage to the apple-trees, apart from the killing of spurs, occurred, the disease not penetrating farther.

On the pears, however, a stern battle has had to be waged to arrest the progress of the disease, especially on the *Beurre Bosc* and *Williams Bon Chretien*. Although the bud-infections were less numerous than on the apples, the disease made such rapid progress that before the cutting-out of infections could be commenced in real earnest large fruiting-arms and whole limbs were involved and had to be removed; and before the first cutting-out could be completed several trees had become so diseased as to require destroying. The pear-trees have had to be examined repeatedly since, and further cutting-back has been found necessary in many instances, until, at the time of writing, the *Williams Bon Chretien* and *Beurre Bosc* present a mutilated appearance. The task of cutting out infections on pears has been so urgent and such an undertaking that much extra labour was required for the purpose, and all other work in the orchard had to be abandoned. The loss to the grower is extremely heavy and difficult to estimate, being of such a multifold character.

Now, the question naturally arises as to the chances of this grower getting rid of fireblight and his orchard remaining free from infection in subsequent years. In the absence of hawthorn hedges near at hand there is a good chance; if hawthorn hedges abound—none. In the writer's experience it is possible to clean up fireblight even in a fair-sized block of large pear-trees, and be free of it in the year following, if sufficient care is taken and the cutting-out of infection is sufficiently drastic. Such cutting-out can be effective where there is no hawthorn to complicate the issue. In the cutting-out of cankers it is wiser to go some distance below the point of visible infection, especially in large limbs, rather than run the risk of allowing diseased wood to remain. Cankered areas are not always conspicuous, and require seeking out by a thorough examination of every portion of the tree. Particularly important in connection with fireblight control is the necessity of having hawthorn hedges in commercial fruit areas removed; otherwise in the event of fireblight reaching a district an orchardist is fighting against impossible odds.

In the matter of control too much is often expected of the Inspector. He has an impossible task unless supported by every orchardist, who should be his own inspector and make sure that he is not harbouring the disease in his own trees. The Inspector can assist by advising as to treatment, taking action against careless individuals, and administering the fireblight regulations in regard to hawthorn, &c. But without the support and co-operation of the people he is endeavouring to protect his efforts will be of no avail. In districts where fireblight does not already exist, growers should be specially vigilant, and organize for the purpose of dealing with the hawthorn question if or when the time comes.

WHEY PASTE AS A PIG-FOOD.*

FEEDING TRIAL AT LINCOLN COLLEGE.

M. J. SCOTT and R. W. GRAHAM, Canterbury Agricultural College, Lincoln.

WHEY as a feed is deficient in protein, fibre, and vitamins. Deficient feeds can be fed to grown animals quite profitably, but when fed to young pigs from weaning up to 60 lb. or 70 lb. weight loss of thrift results. They seldom recover from a check received at this time, and their thrift and subsequent growth is slow and costly. It would appear that inability to carry young pigs over this critical period is at the bottom of most whey-feeding difficulties. Once they pass this critical stage they do fairly well on whey.

Referring to the deficiencies mentioned above, it was considered that the most immediate improvement that could be made was in the protein content by the addition of meat-meal. If this improvement paid for itself there was nothing to hinder the extensive use of meat-meals, since freezing-works are to be found in most whey localities. The first trial was therefore the addition of meat-meal to whey.

Later another trial, using barley (to supply fibre) and meat-meal with whey was started; and although the effect of barley is more than satisfactory, the trial was of little importance, while transport charges make the introduction of barley into whey districts prohibitive.

No information is being collected about the third deficiency (vitamins). It is of some importance where pigs are sty-fed, but since most whey-fed pigs are out on grass it can have little importance in actual practice.

COMPOSITION OF THE PASTE.

The paste supplied to us was solid in some barrels, fluid in others, and fluid above and solid below in others. The average of three samples of each description was as follows:—

Table 1.

				Solid.	Fluid.
				Per Cent.	Per Cent.
Dry matter	..	..	..	58.0	45.0
Protein	..	..	..	6.6	5.2
Chlorides (as NaCl)	..	..	..	2.4	2.1
Acidity (as HCl)	..	..	..	0.7	0.8

The paste had a sickening smell and taste, and was exceedingly bitter. Iron shovels left standing in a solution of whey showed the faintest of copper coatings.

THE FEEDING TRIAL.

The trial here recorded dealt with two lots of pigs, seven in each lot. Both lots were poor and weedy. One lot was fed on whey alone, as much as they could eat; the other had a similar ration, with the

* See article, "The Utilization of Whey," in last month's *Journal*.—Ed.

addition of $\frac{1}{2}$ lb. meat-meal per pig per day, fed separately in dry lot. The pigs were fed inside for thirty days and then outside on a grass-paddock; the trial finished in sixty-three days. While inside the pigs would not eat the paste undiluted, preferring to starve for twenty-four hours, and refusing to eat it even with grain mixed. It was diluted with seven times its weight of water, and troughs kept full with this diluted whey. Lime was added to it at the rate of 1 lb. per 100 lb. of paste. The pigs were put outside as soon as there was any appearance of grass, and tried with solid paste for the third time. This time they ate it readily, and the trial was completed on solid paste.

As is typical with whey-feeding, the pigs scoured very badly, appeared to suffer much from cold, were always shivering, and grew very hairy. In spite of all these things their thrift was very satisfactory—see Table 2, line F (*cf.* Bulletin 2, Scientific and Industrial Research Department, p. 16, Trials 25, 26, 27). The scouring is very objectionable, and it is difficult to give up the opinion that the pigs must do better if scouring were stopped. While feeding the diluted whey we succeeded in stopping it for a while by the addition of burnt lime to the whey, but it came on again when we began to use the paste, probably because it was impossible to mix the lime and paste intimately. The shivering, due to cold weather and the absence of fibre in the paste, was not considered of any importance, since it is not serious in summer weather.

The outstanding feature of the trial not shown in Table 2 is the fact that the whey-alone pigs put on only $\frac{1}{2}$ lb. per pig per day until they were 70 lb. weight. The whey and meat-meal pigs put on just under 1 lb. per day up to the same weight. After 70 lb. weight both lots of pigs put on weight at the same rate—just over 1 lb. per day.

Table 2

Line.		Whey alone.	Whey and $\frac{1}{2}$ lb. Meat-meal per Pig per Day.
A	Number of pigs	7	7
B	Live-weight at beginning of trial .. (lb.)	46.4	52.3
C	Live-weight at end (lb.)	96.1	113.7
D	Increase per pig (lb.)	49.7	61.4
E	Days on trial	63	63
F	Average increase per pig per day .. (lb.)	0.78	0.97
G	Total increase (lb.)	348	430
	Feed—		
H	Whey paste (lb.)	3,118	2,893
J	Equals whey (gal.)	2,494.4	2,314.4
K	Meat-meal (lb.)	..	220
L	Total feed (87 per cent. dry matter) .. (lb.)	1,732	1,882
	Feed to produce 100 lb. live-weight—		
M	Whey paste (lb.)	894	672
N	Equals whey (gal.)	715	537
O	Meat-meal (lb.)	..	51
P	Total feed (lb.)	496	423
	Feed per pig per day—		
Q	Whey paste (lb.)	7.25	6.31
R	Equals whey (gal.)	5.8	5.09
S	Meat-meal (lb.)	..	0.50
T	Total feed (lb.)	4.02	3.65

RETURNS.

As fed in these trials whey alone returned 0.37d. per gallon (gross—no allowance for labour, equipment, &c.) on the basis of pork at 4d. per pound, and 0.559d. per gallon with pork at 6d. per pound. Whey and meat-meal returned 0.37d. per gallon with pork at 4d. and meat-meal £12 10s. per ton, and 0.613d. per gallon with pork at 6d. per pound, and meat-meal as before.

Put in another way, the 220 lb. of meat-meal returned an extra 107 lb. of live-weight, and at 4d. per pound this just pays for the meat-meal. Meat-meal to be profitably used would need to be down to £10 per ton when pork is 4d. Meat-meal, however, keeps pigs healthy and so avoids losses from deaths and lack of thrift. On this score alone it is worth using. It is indispensable with pigs on whey till the pigs are at least 70 lb. weight.

The returns from feeding whey offer no encouragement to those interested in making whey paste. The whey position seems to offer unique opportunities for co-operation between dairy factories and suppliers, such as is practised in other pig-raising communities. If the factories would employ a man and provide equipment in one place at or near the factory to feed one pig per year for every cow supplying the factory, and if each milk-supplier could keep one sow to every ten cows and so supply one weaner per cow each year, even at 4d. per pound for pork, whey would return £1 per cow and the country could turn out 200,000 whey-fed pigs. A man could look after 500 pigs at a time (300-ton factory) quite easily, the whey would be disposed of, and labour and carting equipment dispensed with. We are familiar with the fact that factories have failed in their attempts to use pigs for disposing of their whey, but we are sure that the individual ownership of sows and the use of meat-meal would put an entirely new complexion on the matter.

SUMMARY.

(1) Whey paste diluted was fed to weaner pigs. They drank it quite readily. Later, on pasture, the pigs ate the paste undiluted.

(2) Up to 70 lb. weight the pigs did not thrive on whey alone. After 70 lb. on whey alone, and at all weights with whey and meat-meal, they thrive quite readily.

(3) The paste is similar in its effects to ordinary whey.

(4) Meat-meal can be fed profitably with pork at 4d. per pound if the price of meat-meal is not above £10 per ton.

(5) With present prices of pork there does not appear to be any possibility of evaporated whey being a commercial possibility as far as pig-feeding goes.

Electric Drive for Milk-tester.—An Instructor of the Dairy Division reports: "We have had several runs with the new electrically driven Babcock tester, with satisfactory results. The heating-element inside the cover gives plenty of heat and keeps the samples warm, and they are all in good shape for reading when the run is completed. For the first run or two we had a lot of vibration, and it was necessary to get our bench well stayed to overcome this difficulty."

THE SHEEP BLOW-FLY PEST.

Live-stock Division.

THE sheep blow-fly pest is not nearly so much in evidence in New Zealand as in many other countries, such as Australia, but the flies make their appearance during the warmer months in certain districts. The trouble is not entirely confined to summer; it may occur in the spring or autumn if the season is mild and muggy.

Sheep of all breeds are liable to be affected. A certain amount of immunity from attack by the fly is claimed for some breeds. This so-called immunity in all probability is due to the conformation of the breed. Some breeds, on account of the conformation of the hind quarters, are more liable to staining with urine or fæces. The wool in the region of the crutch becomes "daggy," and there is no doubt that such sheep are a greater attraction to the fly than animals clean in that part.

Lambs are very liable to attack before shearing; in fact, in some districts lambs are chiefly attacked, it being unusual to find ewes affected. Otherwise apparently clean sheep are sometimes affected, especially in showery weather. In such cases the fly is attracted to the sheep by the distinct odour arising from the fleece after rain; on account of skin trouble, such as scald; and also from the greater tendency to scour and staining of the hind quarters in showery weather. Any wound, however small, is an attraction to the fly. Shear-wounds, crutching-wounds, sheep affected with foot-rot, are all liable to be struck by the fly. Cast sheep are very liable to become "struck."

The fly deposits its eggs on any stained part of the fleece or on any part of the body showing skin abrasions or irritation. The most common sites, therefore, are the region of the crutch in the ewe, the back, and in the region of the natural openings of the body, especially if there is any wrinkling of the skin. The depression below the eye may be affected in old and weak ewes. Lambs may be affected in the region of the head and neck, as these parts are liable to be stained by the ewes when the lambs suck from behind.

Each fly is capable of depositing a large number of eggs. The eggs hatch out in a few days, assisted by the heat and moisture of the animal's body. The maggots thus formed set up an irritation of the skin which, if not seen and treated, reduces the animal's strength, eventually causing death, the maggots burrowing into the abdomen in advanced cases. The flies are most active after rain, and are capable of flying a considerable distance.

An animal which has been attacked by the fly may show any of the following symptoms. The animal appears to be irritable and uneasy, and when feeding is frequently seen to stamp one hind leg. Often an animal is noticed with its head down close to the ground, but making no attempt to feed, and frequently moving a few paces, to stop and move on again amongst apparently contented sheep. Occasionally the animal may be seen to turn round and bite at its crutch—when that region is struck, as is usually the case. This act of biting at the crutch is seen especially in lambs. In other cases the

animal separates from the flock and seeks the shade of a stump or tree, where it stamps its feet, wags its tail, and turns quickly from time to time, or bites at the struck part as if to dislodge its irritant.

These symptoms are best noted before the sheep are disturbed. Where the maggots are not numerous and only a small patch is affected there is more difficulty in detection. In the latter cases all ewes showing any signs of irritation, staining of the fleece, a jagged fleece from biting or any other suspicious symptoms, should be caught and carefully examined for the presence of maggots. It may be that the wool over an affected part shows a dirty greyish-black stain, which on closer examination will show an unusual blackish exudite, with a peculiarly offensive odour. The maggots will be found at the base of the wool.

Sheep which have been struck require to be treated by hand if only a few are affected, or if a number are affected dipping may be necessary. The maggots should be removed and destroyed, as each is a possible future blow-fly. The affected area requires to be dressed with some antiseptic, as lysol or Jeyes' Fluid. Sheep-dip is commonly employed, but in this connection a non-arsenical dip should be used, as the danger of absorption of arsenic from the wound cannot be overlooked. Provided the wound or damage done by the maggots is not severe, the application of a deodorant will in most cases prevent reinfestation and allow the wound to heal. At the same time the possibility of the animal being struck again in the same region must not be forgotten.

All known measures should be adopted to prevent, as far as possible, the propagation of the fly. Dagging and crutching are universally carried out with the object of preventing staining of the crutch, which is a big attraction for the fly. The dressing of all wounds at shearing is done mainly with the same intention. So far no preparation has been found which can be used as an application to permanently ward off the attacks of the blow-fly. Arsenical powder dips have given as good results as any others as a preventive.

In districts where the fly is prevalent efforts should be made to eliminate all possible breeding-grounds. All carcasses of dead animals should be buried or burned, the latter course being preferable. Offal from animals killed on the farm should be destroyed by burning, even rabbits receiving attention.

Dr. D. Miller, now entomologist to the Cawthron Institute, has for some time been engaged on research work in connection with parasites of the blow-fly. Several Inspectors of Stock are co-operating with Dr. Miller in the liberation of the parasites at present available. The united effort of all farmers in districts where the fly has made its appearance is essential in order to reduce or eradicate this pest as far as possible.

Rimless Cheese.—The amending regulations under the Dairy Industry Act, 1908, gazetted on 21st December last, include a clause requiring cheese for export to be rimless after 31st July next. Cheese with a rim not deeper than $\frac{1}{4}$ in. will be considered as rimless. Factories still using old-style hoops thus have ample time to get into line.

FARMERS' PASTURE COMPETITIONS.

NORTH TARANAKI RESULTS, 1928.

E. BRUCE LEVY, Agrostologist, and J. M. SMITH, Instructor in Agriculture,
New Plymouth.

THERE is perhaps no better practical method of carrying on field investigation and demonstration work of immediate practical value to the farming community than that afforded by field competitions. The excellent work among root and fodder crops as the outcome of competitions initiated and conducted by Mr. J. W. Deem, Fields Superintendent, has opened up the advisability of extending these competitions to New Zealand's great staple crop, its grasslands.

In comparison with roots, hay, and ensilage crops, where weight of crop is made the prime scoring factor, the judging of grazed pastures, often situated remote from one another, presented considerable difficulty in the awarding of points. However, the application of a technique recently devised by the Department of Agriculture, has resulted in a reliable method of assessing awards, based on botanical composition of the pasture, and hence quality of herbage produced. Botanical composition is fundamental as regards the quality and production of pastures. The botanical composition of a sward, the associating of species one with another, is an analysis in itself of the sum environmental conditions under which that sward is asked to grow. The grassland association, then, is but the response to the environmental conditions that are natural to or are artificially set up on those soil-types we endeavour to grass, and a measure of the association, or the botanical composition of the pasture sward, taken in relation with our knowledge of the factors that produce that association, give us a reliable method of assessing awards to a grazed sward. The point-quadrat method of pasture-analysis affords this measure.*

In addition to botanical composition, there is the all-important point of utilization of herbage produced. Recent research work and practical experience go to show that the same plant varies in food value according to its stage of growth. Young, comparatively short, even-growing, leafy herbage, irrespective almost of what species of pasture-plant we choose, is more palatable and richer and better balanced in the essential milk-production ingredients than is the case when that herbage becomes older or of rank growth. Hence in judging pastures this point of utilization is extremely important, and in this the eye is a fairly reliable instrument for measuring.

Actually botanical composition also reflects utilization. Among our pasture species there are top grasses and bottom grasses. Perfect utilization maintains a balance between the two groups. Close continuous grazing eliminates from the sward virtually all top grasses, such as cocksfoot, timothy, and red clover; while the production of rank feed tends to eliminate from the sward the bottom grasses, such as

* This method consists in making a large number of pin-point quadrats at equally spaced intervals throughout the pasture, recording storey by storey the species of vegetation within each quadrat.

rye-grass, crested dogstail, and white clover. Our experiences in the past have convinced us that that pasture which runs dominantly to and is maintained dominantly in perennial rye-grass and white clover reflects optimum sward-production conditions. These are: (1) High soil-fertility upkeep; (2) perfect soil-drainage—soil not too dry nor yet too wet; (3) efficient aeration, the outcome of drainage and surface cultivation; (4) spread of manure and avoidance of rank, patchy development; (5) perfect utilization of herbage products, by which is set up the correct light-and-shade relationship within the sward, and assuring high nutrient content of herbage consumed.

In summing up the results of botanical analyses, therefore, perennial rye-grass and white clover score the highest individual points. The points allotted for each species (see tables) are more or less arbitrary—that is, they are not based on actual measured production from each individual species; but in this arrangement of points we have endeavoured to show as accurately as possible the relative values of those pastures wherein dominance is attained by any one particular species or set of species. Thus we consider a dominant rye-grass and white-clover pasture approximately two and a half times better than one in which Yorkshire fog and brown-top are dominant, and some ten times as high in production as where such plants as sweet vernal, catsear, rib-grass, &c., are dominant. Further, this grading of species gives credit or otherwise for the actual conditions for pasture-plant life reflected in what the soil-type is supporting. Thus, if a soil-type can only support a sweet vernal, catsear, and rib-grass dominant association we know that that country is starved and poorly farmed, and that this is the best Nature can do under the existing conditions. It impresses a much-needed lesson—recognition of the fact that botanical composition reflects exactly the conditions under which the sward is asked to grow. This system of awarding points penalizes the poor-conditioned soils and encourages the effort to improve, for so surely as we improve, so more and more of the high-scoring species will appear in the pasture.

A difficulty that exists in almost all field competitions lies in awarding so that credit is given to the farmer for crops or pastures produced on naturally infertile soils. It would seem imperative that a classification of soil-types, measured largely by the natural volunteer grass sward that such soil reverts to in an unimproved condition, should be made prior to any comprehensive competition scheme.

So far as the areas in the competitions under review are concerned, the soil-type throughout is fairly uniform and may be classified as naturally sweet vernal, catsear, and rib-grass dominant, running ultimately to *Danthonia pilosa* dominant. This soil-type is by no means first-class country in the unimproved state, and it appears that annual or twice-a-year applications of artificial manures will be necessary to bring it up to the rye-grass and white-clover standard of soil-fertility. Be this as it may, from an examination of the analyses contained in the accompanying tables it will be seen that the winning farmers are getting near the mark, while others have yet a long way to go. The point we wish to make here, however, is the necessity of classifying the soil-types so that any improvement that has been effected may be strictly comparable and be given credit within the group offering in the competition.

Table 1.—*Pasture Competition, Lepperton, 1928: Details of Botanical Analyses, Marks gained, and Place in Competition.*

Name of Species.	J. N. Blyde.		W. D. Cartwright.		F. T. Crowe.		A. N. McLeod.		H. E. Blyde.		W. A. Cartwright.		C. J. Oliver.		H. Woisen.		W. N. Ackland.		W. D. Foreman.		Don. Farm, Stratford.	
	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.	Average Hits per 100 Points examined.	Marks gained by each Species.
Bare ground ..	9.25	0	5	0	4	0	5	0	4.25	0	4.75	0	5.75	0	4	0	4.50	0	7.50	0	6.75	0
Perennial ryegrass ..	26.00	260.00	10.25	102.50	37.50	375.00	5.25	52.50	9.75	97.50	29.75	297.50	20.75	207.50	28.25	282.50	29.50	295.00	5.50	55.00	64.50	640.00
White clover ..	17.25	172.50	12.25	122.50	35.00	350.00	6.00	60.00	19.50	195.00	10.00	100.00	7.50	75.00	7.25	72.50	27.75	277.50	11.00	110.00	21.50	215.00
Cocksfoot ..	5.50	44.00	10.00	80.00	6.75	54.00	8.75	70.00	10.50	84.00	6.00	48.00	5.00	40.00	4.75	38.00	6.75	54.00	12.25	98.00	19.50	156.00
Crested dogtail ..	2.50	20.00	11.00	88.00	12.25	98.00	2.25	18.00	2.75	20.00	5.00	40.00	1.50	12.00	1.00	8.00	8.75	70.00	0.50	4.00	7.25	58.00
Timothy ..	..	..	0.25	2.00	0.75	6.00	..	..	0.25	2.00	0.75	6.00	0.50	4.00	..	..	0.50	4.00	0.75	6.00	2.75	22.00
Poa trivialis ..	1.50	12.00	0.25	2.00	..	..	..	..	1.50	12.00	..	..	0.25	2.00	0.50	4.00	..	..	..	..	..	..
Red clover ..	0.25	2.00	2.00	16.00	..	..	3.75	30.00	1.50	12.00	0.25	2.00	0.25	2.00	0.50	4.00	0.50	4.00	..	..	9.50	76.00
Plantain ..	25.00	150.00	10.00	60.00	5.75	34.50	42.50	163.00	6.50	60.00	9.25	54.50	5.75	34.50	11.75	70.50	6.25	37.50	22.00	132.00	0.25	2.00
Suckler clover ..	0.25	2.00	25.75	103.00	4.75	19.00	1.50	12.00	4.50	20.00	21.00	84.00	6.25	27.00	21.00	84.00	12.25	49.00	3.75	15.00	1.75	7.00
Lotus major ..	0.25	2.00	..	..	4.00	16.00	1.75	30.00	0.75	6.00	0.25	2.00	3.75	15.00	1.25	5.00	0.75	3.00	15.50	30.00	0.25	2.00
Brown-top ..	..	..	..	..	4.50	18.00	9.75	39.00	9.00	30.00	18.00	72.00	9.75	39.00	15.50	62.00	14.25	49.00	0.75	3.00	0.25	2.00
Yorkshire fog ..	4.75	19.00	5.25	21.00	0.25	2.00	0.25	2.00	0.25	2.00	0.25	2.00	0.25	2.00	0.25	2.00	0.25	2.00	0.25	2.00	0.25	2.00
Rattail ..	..	..	1.25	2.50	..	..	0.25	2.00	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Danthonia pilosa ..	6.25	12.50	5.75	11.50	..	..	0.50	2.00	..	..	1.50	1.50	..	..	0.25	2.00	0.25	2.00	0.25	2.00	..	..
Chequings fescue ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Knee-jointed foxtail ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Goose-grass ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hair-grass ..	15.50	155.00	16.00	160.00	16.75	167.50	11.00	110.00	18.25	182.50	19.75	197.50	18.50	185.00	15.25	152.50	12.50	125.00	0.75	6.00	..	..
Sweet vernal ..	5.75	57.50	18.75	187.50	33.00	330.00	14.00	140.00	38.50	385.00	13.00	130.00	23.75	237.50	23.25	232.50	23.75	237.50	16.25	162.50	1.50	15.00
Rib-grass ..	14.50	145.00	28.50	285.00	15.00	150.00	10.75	107.50	19.50	195.00	12.25	122.50	23.00	230.00	19.75	197.50	16.00	160.00	17.25	172.50	1.50	15.00
Harward ..	..	..	1.00	10.00	1.00	10.00	0.75	7.50	1.25	12.50	2.25	22.50	3.25	32.50	3.00	30.00	2.50	25.00	3.50	35.00	0.50	5.00
Slender chickweed ..	..	..	0.75	7.50	0.50	5.00	1.25	12.50	0.75	7.50	0.50	5.00	0.50	5.00	1.50	15.00	0.25	2.50	2.25	22.50	0.50	5.00
Creeping buttercup ..	0.50	5.00	2.75	27.50	1.50	15.00	0.75	7.50	0.50	5.00	0.50	5.00	0.50	5.00	0.50	5.00	0.50	5.00	1.50	15.00	0.50	5.00
Veronica agrestis ..	..	..	0.50	5.00	0.25	2.50	..	..	4.25	42.50	1.00	10.00	1.00	10.00	1.50	15.00	1.25	12.50	0.75	7.50	0.75	7.50
Australian flax ..	..	..	0.50	5.00	0.25	2.50	..	..	..	..	1.00	10.00	..	..	..	..	..	..	..	..	..	..
Sedgemoor ..	..	..	1.00	10.00	1.50	15.00	3.00	30.00	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Geranium molle ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Field daisy ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Yarrow ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total hits per 100 points ..	125.75	..	162.75	..	162.50	..	119.75	..	160.25	..	152.75	..	142.50	..	157.50	..	164.75	..	135.00	..	149.75	..
Total marks for species ..	729.25	..	670.25	..	670.25	..	596.25	..	636.00	..	749.75	..	598.00	..	686.75	..	909.75	..	544.00	..	1,243.75	..
Utilization (max. 100) ..	100.00	..	20.00	..	80.00	..	100.00	..	100.00	..	70.00	..	60.00	..	80.00	..	90.00	..	70.00	..	100.00	..
Grand total marks ..	809.25	..	690.25	..	690.25	..	696.25	..	696.00	..	819.75	..	686.00	..	766.75	..	999.75	..	614.00	..	1,343.75	..
Place in competition ..	3rd	..	8th	..	2nd	..	6th	..	7th	..	4th	..	9th	..	5th	..	1st	..	10th	..	..	..

Note.—For scale of marks allotted per hit per species see last column of Table 2.

Table 2.—*Pasture Competition, Tihcrangi, 1928: Details of Botanical Analyses, Marks gained, and Place in Competition.*

Name of Species.	J. Faulger.	F. C. Blyde.	H. P. Sarten.	H. Foreman.	D. Griffiths.	R. Rolfe.	T. Hine.	C. S. Carmichael.	R. McKenzie.	J. Vickery.	Marks allotted per Hit per Species.
Bare ground	3.75	0	5	6	4.75	0	0	6.25	0	0	9
Perennial rye-grass	21.75	23.50	15.50	22.25	9.25	10.75	3.00	11.25	49.50	105.00	10
White clover	15.25	18.75	24.75	15.75	29.00	5.25	17.00	6.25	7.00	11.25	10
Cocksfoot ..	17.00	13.00	9.75	12.50	10.00	8.25	7.00	4.75	13.50	3.50	8
Timothy	..	1.00	..	0.50	0.75	6.25	7.30	..	4.75	13.00	8
Poa trivialis	..	..	2.75	..	1.50	5.00	58.40	..	2.00	104.00	8
Red clover	..	..	..	..	1.00	0.25	16.00	..	9.50	..	8
Poa pratensis	15.25	11.00	9.25	11.50	0.25	6.00	39.60	0.25	42.00	8.75	8
Paspalum	..	..	..	..	14.50	97.50	..	8.25	7.00	31.50	6
Suckling clover	5.50	2.25	3.75	0.50	8.25	10.25	32.60	40.25	0.75	0.50	6
Lotus major	..	..	..	..	2.00	28.00	2.00	16.00	0.25	13.75	4
Brown-top	..	..	..	..	..	..	2.60	10.40	8.25	33.00	4
Yorkshire fog	5.25	21.00	1.00	0.25	..	1.00	11.00	9.00	2.75	12.75	4
Anthoxanthum	..	..	6.25	13.75	5.50	30.00	44.00	11.75	11.00	7.50	4
Dactylis glomerata	..	..	..	..	..	1.00	2.00	2.00	..	30.00	4
Chewing fescue	..	..	..	..	..	..	..	4.75	0.50	2.00	2
Crepeping bent	..	..	..	..	7.25	..	..	..	..	..	2
Poa annua	1.00	1.00	0.50	0.25	0.25	..	..	..	1.25	0.25	2
Goose-grass	..	0.25	0.25	..	..	0.25	..	..	1.25	0.25	2
Hair-grass ..	..	..	..	..	..	..	..	..	1.25	0.25	2
Sweet vernal	35.00	29.00	27.50	21.75	11.75	17.50	14.00	0.25	4.25	0.50	1
Cat-tail ..	18.25	18.50	22.25	14.25	26.25	22.50	17.30	19.75	22.75	17.00	1
Rib-grass ..	18.50	16.00	11.00	15.00	12.75	15.00	18.60	24.75	9.50	23.00	1
Handkerchief	..	1.00	0.50	0.50	0.50	0.50	..	..	14.50	9.75	1
Plantain	1.50	3.00	5.75	0.25	4.00	1.25	..	0.75	0.50	0.50	1
Greater chickweed	..	..	1.50	1.25	0.50	..	..	..	1.00	0.75	1
Slender chickweed	..	1.00	1.50	1.25	0.50	..	..	..	..	..	1
Crepeping buttercup	0.75	0.75	0.75	1.25	0.50	0.75	0.60	1.25	7.75	0.25	1
Selfweed ..	..	0.25	0.75	1.25	2.50	0.75	4.30	0.25	0.25	..	1
Sudweed ..	..	1.50	0.50	1.25	0.50	0.50	..	0.75	0.25	..	1
Selfweed ..	..	1.50	1.00	1.25	0.75	0.75	..	..	0.25	0.25	1
Sagina ..	..	..	..	..	..	..	..	..	..	..	1
Field daisy ..	..	0.25	0.50	..	..	..	..	..	..	..	1
Lotus hispidus	..	0.25	0.25	..	..	..	..	..	..	..	1
Veronica agrestis	..	0.25	0.25	..	..	..	..	..	..	..	1
Total hits per 100 Points	155.00	139.25	143.75	131.00	151.50	147.75	128.50	165.00	169.75	143.25	..
Total marks for species	714.00	668.50	661.50	660.00	708.25	608.25	916.60	563.75	929.00	678.25	..
Utilization (max. 100)	100.00	..	50.00	90.00	100.00	50.00	10.00	40.00	..	100.00	..
Grand total marks	814.50	669.50	712.50	730.00	808.25	658.25	926.60	603.75	989.00	778.25	..
Place in competition	3rd	8th	7th	6th	4th	9th	2nd	10th	1st	5th	..

The outstanding features of the pastures as shown in these analyses are: (1) The predominance throughout of the low-production species—sweet vernal, catsear, and rib-grass—as compared with normal high-class pasture;* (2) the comparatively unimportant place occupied by cocksfoot, timothy, and red clover; (3) the high *Poa pratensis* content, which in many cases far exceeds that of cocksfoot and crested dogstail; and (4) the variation in rye-grass and white-clover content as an outcome largely of different standards of soil-fertility set up.

It will be obvious to readers that many of the pastures entered are not really up to competition standard. In fairness to these, due allowance must be made for the fact that entries were not called for until late, and that many of the best fields were then shut up for hay or ensilage. The real object of the competition, however, is to enable a farmer to know his pasture, and to help towards that improvement which will lead ultimately to the ideal—a perennial rye-grass and white-clover dominant pasture.

In conclusion we would like to point out that these are the first pasture competitions held in New Zealand, and we wish to convey our appreciation to the farmers of Lepperton and Tikorangi districts for the enthusiastic way in which this matter was taken up by their respective branches of the Farmers' Union. Due acknowledgment is also made to Messrs. E. A. Madden and C. Haynes for assistance with the pasture analyses.

*For comparative purposes we have included in Table 1 (last columns) a high-class ten-year-old pasture at the Stratford Demonstration Farm.

STATISTICS OF FARM MACHINERY AND ENGINES.

FOLLOWING is a summary of farm machinery and engines employed on rural holdings (outside borough boundaries) in New Zealand for the past five years:—

Class of Machinery, &c.	1924	1925.	1926.	1927.	1928.
Milking-plants	14,553	15,501	16,391	17,090	18,049
Cream separators	42,473	44,056	45,705	45,246	45,246
Shearing-machines—					
Plants	5,480	5,728	5,949	6,305	6,518
Stands	17,844	18,445	18,797	19,269	19,677
Wool-presses	8,035	8,601	8,641	8,832	9,504
Agricultural tractors	512	1,026	2,025	2,588	2,883
Reapers-and-binders	15,048	15,881	15,574	15,287	15,432
Threshing-machines	332	377	361	364	406
Chaffcutters	2,970	2,903	2,865	2,562	2,326
Water-wheels or motors	871	846	817	784	932
Electric motors	2,587	3,451	6,356	8,436	10,806
Steam-engines	626	622	473	435	505
Internal-combustion engines	18,864	19,894	19,584	18,885	18,321

WEEDS AND THEIR IDENTIFICATION.

THREE COMMON DOCKS (*RUMEX* spp.).

ESMOND ATKINSON, Department of Agriculture, Wellington.

THE Second Schedule of the Noxious Weeds Act includes automatically all species of the genus *Rumex* that are found in New Zealand. Strictly speaking, this would involve two native and six introduced docks, as well as sorrel proper and sheep's sorrel. Most of these, however, are not common enough to be agriculturally important, while the commonest and most important of all (sheep's sorrel) is only botanically speaking a "dock." Only three species will therefore be illustrated in this article—broad-leaved dock (*Rumex obtusifolius*), curled or narrow-leaved dock (*Rumex crispus*), and Maori dock (*Rumex flexuosus*).

The following is a key to give a rough idea of the differences between these three species :—

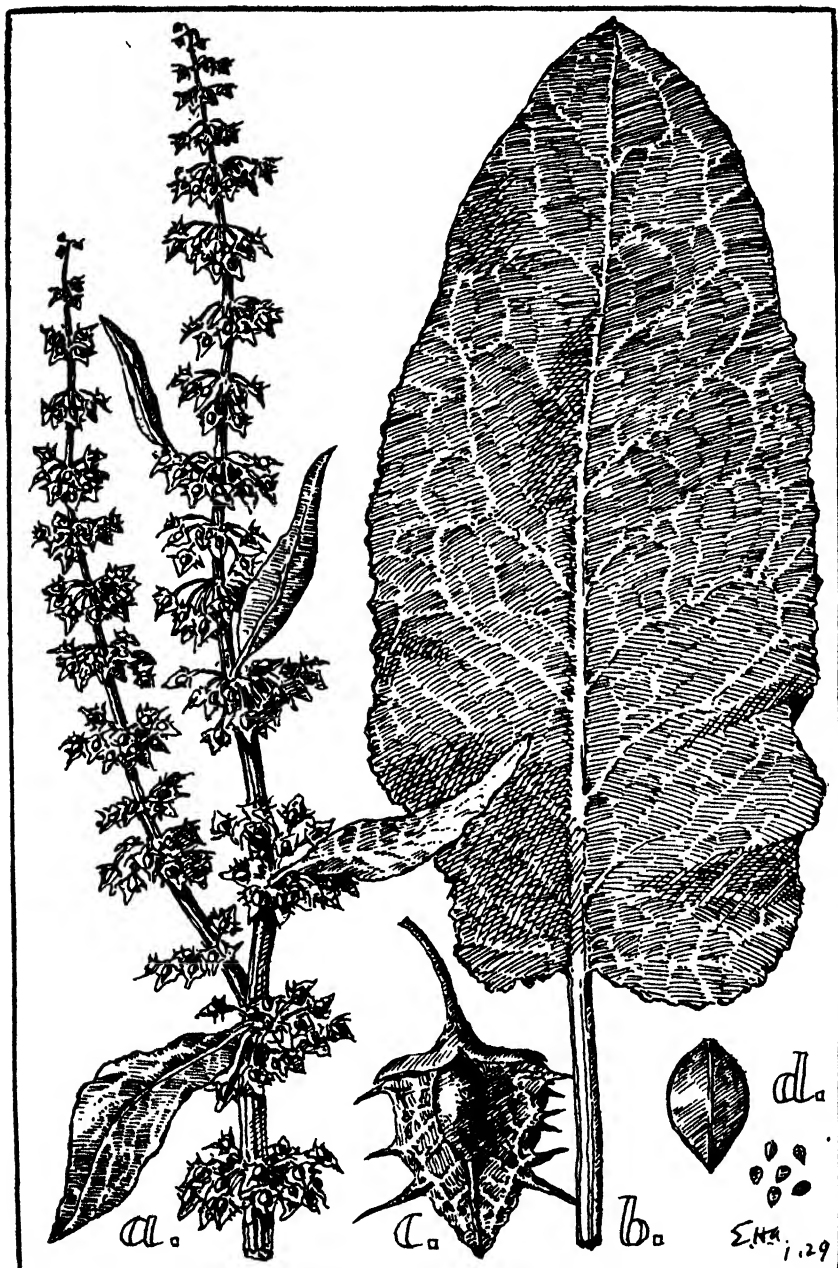
- (1) Tall upright plants several feet high, with long tap-roots :—
 - (a) Lower leaves several inches wide, base heart-shaped, margins flat *R. obtusifolius*.
 - (b) Lower leaves much narrower, lance-shaped, margins very much waved *R. crispus*.
- (2) Plant with much smaller tap-root and leaves, and straggling wiry-looking stems *R. flexuosus*.

The docks belong to a family of plants, known botanically as the *Polygonaceae*, which for its size includes few that are useful—rhubarb and buckwheat being the best known of these latter. In New Zealand there are several members of this family, besides the sorrels and docks, that are important weeds—for example, wire weed (*Polygonum aviculare*) and smartweed (*Polygonum Persicaria*). The latter was described and illustrated under the name of "lady's thumb" in the *Journal* for January, 1928.

BROAD-LEAVED DOCK.

Probably the commonest of the docks, and according to G. M. Thomson ("The Naturalisation of Animals and Plants in New Zealand") certainly the most so in the South Island, is the broad-leaved dock. It was first reported not far from a hundred years ago, though there is often doubt about the accuracy of these early identifications. At any rate, this species and curled dock are now among the most abundant weeds of pastures on the heavier soils, and both make a great show along damp roadsides and in waste places.

Broad-leaved dock is a perennial, up to 1 yard or more in height, with a strong and deeply penetrating dark-coloured tap-root (carrots and parsnips are typical examples of tap-roots), and abundant root-leaves with long stalks and dark-green blades 1 ft. or so in length and several inches wide, with heart-shaped bases, blunt tips, and crinkled but not waved edges. Leaves are very often seen the same size as those illustrated (Fig. 1 (b)), but in luxuriant plants they are perhaps twice as big. There may be a number of stems from one root, but as a rule they do not branch much except at the tops, where the flowers are

FIG 1. BROAD-LEAVED DOCK (*RUMEX OBTUSIFOLIUS*).

(a) Fruiting shoot, natural size; (b) leaf, natural size; (c) fruit, magnified; (d) seed, natural size and magnified.

[Drawing by Esmond Athinson

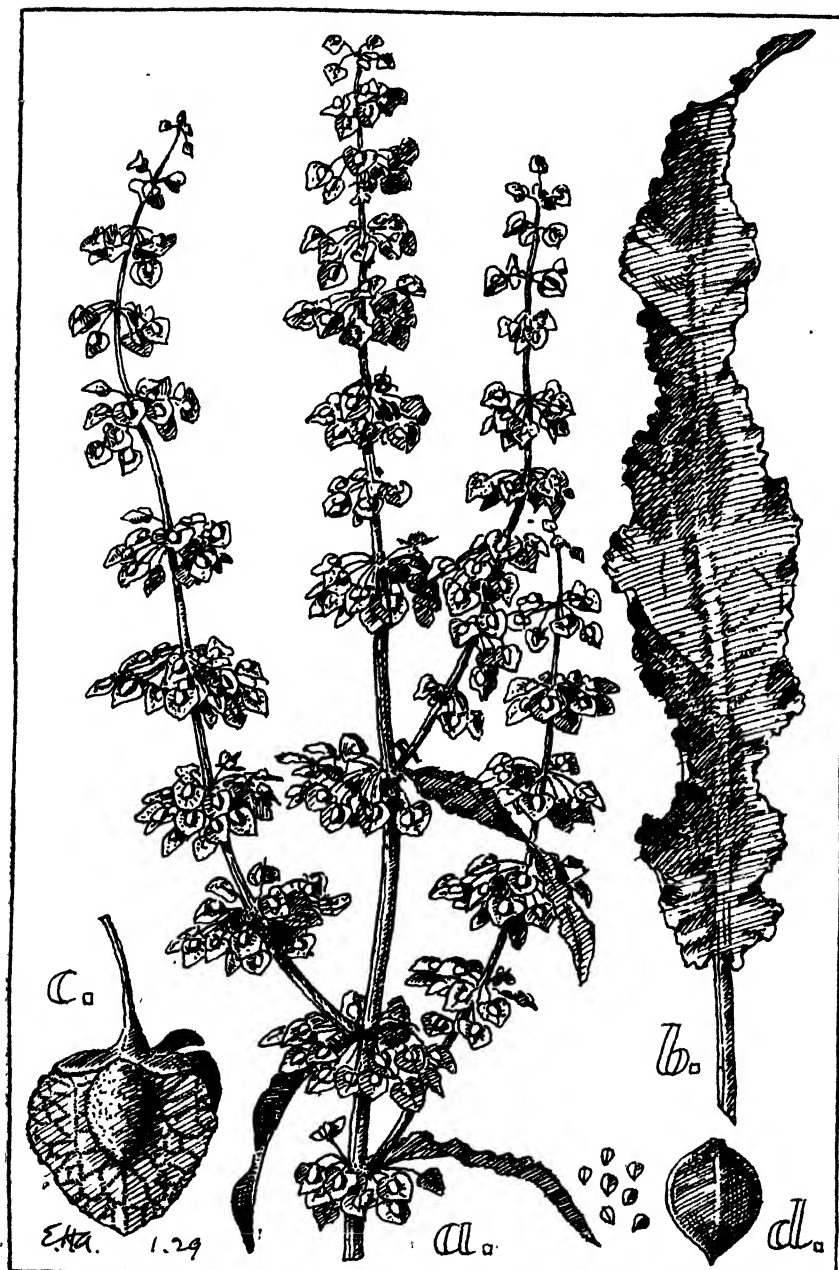


FIG. 2. CURLED DOCK (*RUMEX CRISPUS*).

(a) Fruiting shoot, natural size; (b) leaf, natural size; (c) fruit, magnified; (d) seed, natural size and magnified.

[Drawing by Esmond Atkinson.]

borne. They have small scattered leaves which are quite unlike those described, being much narrower in proportion and with short stalks or none at all.

The way the flowers are carried in long finger-shaped spikes is shown in Fig. 1 (a). The clusters of flowers round the axis may be so close as to make the spike a continuous one, or they may be far enough apart to show quite a lot of the stem. The amount of exposure to light, &c., is the factor that causes these differences in the appearance of individual plants. The flowers themselves have not been shown in the drawing, but only the young and ripe fruits, which have features that make them the surest way of telling one dock from another.

It is worth getting some idea of the structure of the flower, which consists of six segments—three inner and three outer (Fig. 1 (c)). After the actual flowering is over and the "seed" begins to ripen (only one is borne by each flower) the inner segments enlarge with the growing of the seed and continue to enclose it. In many of the docks these coverings become very strongly coloured with various reds, purples, and browns, and make the whole plant very showy, but in shadier places they often stay quite green.

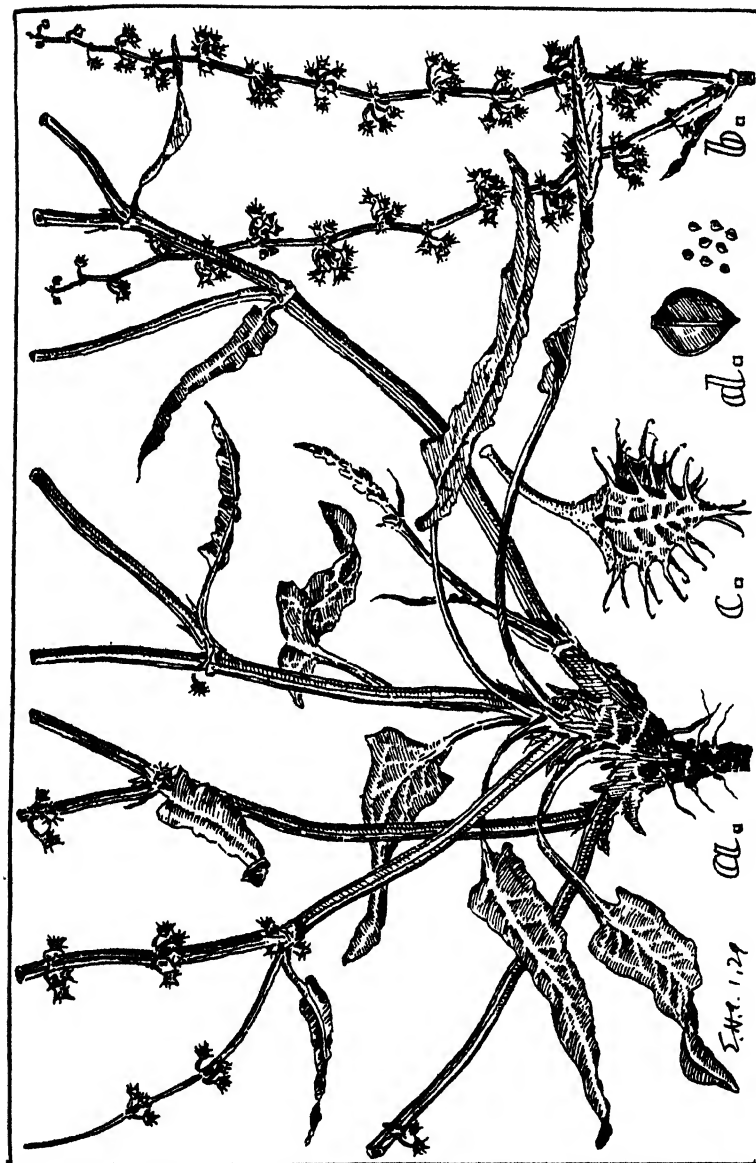
The appearance of the fruit in broad-leaved dock is shown in the illustration, and the differences between the fruits of this species and curled dock will be pointed out later. The "seed" is shown at Fig. 1 (d). It is triangular in section, brown-coloured, and shiny.

CURLED DOCK OR NARROW-LEAVED DOCK.

This species need not be described in so much detail as the last, but the chief differences will be pointed out. It has the same type of root, but the root-leaves (Fig. 2 (b)) are strikingly different in being only about half the width, gradually tapering at the tip, and with very strongly waved edges—whence the name "curled dock." There is not much difference in the size and general appearance of the stems or in the flowers. What distinguishes the two plants at once is the shape of the seed-coverings (Fig. 2 (c)). The illustration will make this clear. In broad-leaved dock each of the three segments is roughly triangular, and has several conspicuous teeth along the sides. In curled dock the segments are broader, more or less heart-shaped, and without any teeth along the edge. In both species there is in the middle of the segment a nodule or tubercle, which ends abruptly in curled dock and tapers into a vein in broad-leaved dock. The "seeds" of the former are much the same, but are rather shorter and wider.

MAORI DOCK.

This is often called "native dock" or "rolling dock." There is no question of any confusion between this species and the two common introduced ones just described. It has a small perennial tap-root, and—compared with the other two—quite small root-leaves, which are often more or less brown in colour and sometimes show a trace of the characteristic shape of a sorrel-leaf. The stems are not stiff and upright, but branch from the base and sometimes straggle for several feet through other vegetation.

FIG. 3. MAORI DOCK (*RUMEX FLEXUOSUS*).

(a) Lower portion of plant, natural size; (b) fruiting shoot, natural size; (c) fruit, magnified; (d) seed, natural size and magnified.

[Drawing by Esmond Atkinson.]

The name "rolling dock" is given from the fact that in open country the tangled mass of stems often breaks off when the seed is ripe, and is blown over the surface of the ground for quite long distances. The illustration (Fig. 3 (c)) shows a most characteristic feature of the seed-covering—namely, the hooked spines, which are analogous to the barbed spines of pipiriri and serve the same purpose in seed-distribution. As a matter of fact, the specimens from which the drawing was made were growing within a few inches of plants of the large purple pipiriri (*Acaena novae zelandiae*) and the Australian burr (*Acaena ovina*)—a curious coincidence if all three were not brought there by the same means.

Maori dock is widely spread in all types of country from sea-level to 4,000 ft. It is not found anywhere except in New Zealand, but is related to an Australian species.

OTHER INTRODUCED SPECIES.

It is possible that there may be some little confusion between those described and one or other of the remaining introduced species of *Rumex*.

Fiddle dock (*Rumex pulcher*) is frequent in fields and waste places. It has leaves of the shape indicated by its common name.

Clustered dock (*Rumex conglomeratus*) is found in the same situations, but is less common. It has rather leafy stems, and seed-coverings with almost entire edges like those of curled dock.

Red- or green-veined dock (*Rumex sanguineus*) is another fairly common species, with two forms—a red and a green veined one—the latter being much the more common here. It has seed-coverings of the same toothless type as those of curled and clustered docks.

Sheep's sorrel (*Rumex acetosella*) is well enough known to every one. The true sorrel (*Rumex acetosa*) is sometimes mistaken for it, but is rather larger and is without creeping underground stems.

POSITION AS WEEDS, ETC.

There is little to be said about control methods. Generally speaking, the aggressiveness of the docks as weeds lies in their power of sending out new shoots from the perennial tap-roots when these have been cut off. Hilgendorf ("Weeds of New Zealand") refers to the use of a sprinkle of ammonium sulphate, and mentions further that it has the advantage of being a valuable fertilizer to grasses. Common salt is sometimes used in a similar way on lawns, &c.

The seeds of docks are very frequent impurities in lines of agricultural seeds. E. Bruce Levy (*Journal*, Feb., 1915) says that curled-dock seeds are found chiefly in lucerne, broad-leaved in cocksfoot.

New Zealand Institute Fellowships.—At the annual meeting of the Board of Governors of the New Zealand Institute held at Auckland last month, Dr. G. H. Cunningham (Plant Research Station, Palmerston North), and Dr. J. Henderson (Geological Survey), were elected Fellows of the Institute.

SEASONAL NOTES.

THE FARM.

TOP-DRESSING AND PASTURE MANAGEMENT.

RYE-GRASS, after being practically dormant in January and February, usually starts its autumn growth in March and grows on into early June. Early autumn top-dressing increases the rye-grass growth in the late autumn and early winter, and thus helps to increase the winter carrying-capacity of grassland.

On sheep-farms where the stock-carrying capacity is entirely limited by the winter growth of grass, fertilizers for top-dressing should be applied in March or early April. This is very necessary if the ewe stock on the farm is to be increased, so that the cost of fertilizers may be recovered and a profit obtained on the top-dressing. On dairy-farms top-dressing pays through increased butterfat-production, even though the number of cows milked may not be increased; on sheep-farms, although the cost of the fertilizers may ultimately be recovered from increased production of wool and a higher percentage of fat lambs, without greatly increasing the number of sheep carried, it is usually necessary to carry more ewes to obtain an immediate return from the application of fertilizers and thus render top-dressing a profitable practice. This is particularly true for moderately good grassland being top-dressed for the first time. For unless the stocking is increased to cope with the greatly increased grass-growth which occurs the following spring the grass may get ahead of the sheep and the lambs do badly. On quite poor surface-sown grassland, however, it may take two or even three applications of phosphatic fertilizers before the stock-carrying capacity of the grassland is greatly increased. Another advantage of early top-dressing on hill country is that it allows the best use to be made of fine weather. Later, when the hills become wet and slippery, great difficulty is often experienced in getting the material on the ground, and the cost of applying is materially increased.

On dairy-farms the commencement of the autumn growth of rye-grass is usually reflected in a slight rise in butterfat-production in late February and early March, and this rise is followed by a gradual decline as the herds are dried off. Early autumn top-dressing is now becoming fairly common on dairy-farms, and it is a practice that helps to increase the winter carrying-capacity of the grassland. The milking of late-calving cows through the winter is now usual, and a reasonable winter production from these cows can only be obtained if a fair grass-growth is available for feeding in addition to the ordinary rations of hay and roots, or hay and silage. Phosphatic fertilizers, particularly superphosphate, have proved beneficial in increasing the autumn growth of grass, and it remains to be seen whether a much larger growth may not be obtained from nitrogenous fertilizers in addition to the ordinary application of phosphates. Applications of nitrogen in the winter have proved beneficial in increasing the spring growth of grass, but spring and summer applications of nitrogen have been *rather disappointing*.

Before pastures are top-dressed in the early autumn all rank growth should be grazed or mown off, and the field thoroughly chain- and tripod-harrowed as soon as the droppings have been sufficiently softened by rain to render them easy to spread.

CROP-PRODUCTION.

Grassland intended for wheat should be skim-ploughed before the middle of March. After skim-ploughing the furrows should be left unbroken for a month or six weeks to allow the turf to rot, and the land then disked so that the turf is thoroughly broken up before deep ploughing. The two ploughings of grassland for wheat are very necessary in order to allow the vegetation to decay and to obtain a fine firm seed-bed.

Special catch-crops of oats or barley for winter and spring green feed should be sown in March or early April. At one time cereal catch-crops for spring green feed were fairly common on dairy-farms, but with the gradual improvement of dairying grassland their use has declined. Any cultivated land, however, that will not be used till the spring can well be sown in oats or barley for winter and spring feeding. Green cereals provide very desirable feed for milking-cows in the late winter and early spring, and the light land common to most dairying districts is better occupied by a crop than left fallow over the winter. On dairy-farms where the pastures are predominantly rye-grass it is probable that early spring feed will be more cheaply provided by the application of nitrogenous fertilizers to grassland than by special catch-crops of green cereals.

Red clover is usually cut for seed about three months after the hay crop. When the clover-seed can be rubbed out from the majority of the heads and the stalks begin to lie at an angle of 45 degrees it is time to cut.

The linseed crop will be ready for harvesting early in March. The crop is ready to cut when the cobs, if rubbed between the hands, open easily and shed the seed. The crop should be allowed to remain in the stook till dry; this will take from two to three weeks. The crop is most conveniently threshed from the stook.

AUTUMN-SOWING OF PASTURES.

March is usually the best month for sowing permanent and temporary pastures on ploughed land. Sowing in February is often unsatisfactory owing to the uncertain rainfall; in years of good rainfall, however, February sowings do remarkably well. The seed-bed for sowing grass should be fine and firm from top to bottom. The cultivation operations should be finished with a rolling, and the seed and fertilizer broadcast on the rolled surface. The seed can then be covered with a stroke of light tine or chain harrows, and the land finally rolled again. The mixtures used for permanent pasture naturally vary with the soil-conditions and climate. Standard mixtures suitable for various conditions are given in the Department's Bulletin, No. 107, "Grasslands of New Zealand." Advice required about grass mixtures for particular conditions should be sought from the district Instructors in Agriculture.

—P. W. Smallfield, B.Ag., *Fields Superintendent, Auckland.*

SHEEP-DIPPING.

Loss of condition in a flock is caused sometimes through parasites such as lice and keds (commonly spoken of as ticks). Constant scratching and biting and rubbing against posts and fences are the most common symptoms. A lice-infected animal cannot do justice to the food it eats. The staining of the fleece from parasites reduces its value considerably. Apart from the fact that the animal thrives better, the fleece is improved in value by dipping.

If the sheep are infested with lice a double dipping is essential to thoroughly eradicate the parasite. The first dipping kills off the living vermin, but those which hatch out from the eggs during the next ten days remain, so that the second dipping, to be effective, requires to be carried out within fourteen days. The louse is a small parasite and requires to be carefully looked for, otherwise it may escape notice. It lays a large number of eggs, which are attached to the wool-fibres.

Practically all the standard dips on the market to-day are suitable if the mixing of the dip is carried out strictly to instructions supplied on each packet or drum of the dip used. One of the most common causes of failure is insufficient immersion. Each sheep should be held for at least one minute in the bath, with two minutes for long-woolled sheep. The head should always be immersed.

Dipping in a dirty bath reduces the strength of the dip. The bath should be cleaned out at proper intervals, and the following rules also observed: (1) Avoid dipping in wet weather; (2) measure accurately the bath-water; (3) dissolve the powder thoroughly before using; (4) mix the dip properly; (5) keep stirring the bath; (6) use the dip full strength.

FLUSHING THE BREEDING-EWES.

On fat-lamb-raising farms in the North Island the rams are usually put out at the end of February or early in March. Flushing, by feeding the ewes on some succulent feed for a week or ten days before the rams go out, helps to increase the lambing percentage. Flushing can be done by running the ewes on rape after the first feeding-off by the lambs, or, where there is no rape, on the best pastures available.

—*Live-stock Division.*

THE ORCHARD.

FRUIT-MARKETING.

THE work of harvesting and marketing the main portion of the fruit crop will now be requiring the concentrated effort of every commercial orchardist. In most instances consideration is being given to both local and export markets. Fortunately, the export grading and packing is supervised and standards adhered to. Fruit for the local market, however, providing it is free from disease, is still allowed to be distributed without restriction as regards grade. No doubt growers who have engaged in export have improved their local market standard of pack and grade. Nevertheless large quantities of low-grade fruit flood the local markets, with the inevitable low price.

It is fully agreed that the quantity of low-grade fruit going on the local market has a very dulling effect, and that such fruit, hardly realizing sufficient to cover expenses, seriously affects the profitable disposal of good lines and interferes with the demand.

The question arises as to what class of fruit should be treated as low grade and not marketed as fresh fruit. The next problem is the profitable disposal of this undergrade fruit. Fruit must be considered of low grade or unfit for the market if immature or undersized. These two faults may be rectified—first by refraining from picking fruit till sufficiently mature. Making several pickings, each time with a careful selection, helps in this direction. The quantity of undersized fruits may be brought down to a negligible quantity by careful and adequate thinning and care in picking, avoiding the picking of undersized fruit. Small fruit will generally come up to size if left for a time after the tree has been relieved of its load.

Diseased fruit—that is, fruit affected chiefly with conspicuous black-spot, San Jose and other scales, and codlin-moth (or, in the absence of moth, numerous strings)—is fruit which should be rejected, being of low grade. Fruit heavily russeted, carrying conspicuous blemish in the way of branch rubs, cracks, beetle marks, &c., is all low grade and is not sought after. Unfortunately, some growers have too much of the undersized, diseased, and blemished fruit and feel tempted to market it. They then wonder why fruit brings such a low price and the orchard is not profitable.

The solution to the question is not so much in finding a means of profitably disposing of low-grade fruit other than selling it as fresh fruit—as this only gives encouragement to its production—but in bringing about an improved general condition of orchards by encouraging the growing of better-quality fruit, and in bringing down the quality of rejects to a level when an orchardist can dump this fruit or feed it to pigs without regret. The chief factors in profitable fruit-production which the grower may control are cultivation, manuring, thinning, disease-control, and pruning. All these are governing factors in the maintenance of health and vigour in the tree, which is essential. Pests and diseases which have a debilitating effect on the tree through injury to foliage should be fought strenuously; often they receive little attention.

Having produced good marketable fruit and used discretion in harvesting the crop, the need for some care in preparing for market should receive consideration. The maintenance of a good standard of grade and pack, the use of clean new cases, and an attractive “get up” will secure more for the grower than an article put up in a slovenly manner.

SOME FURTHER EXPORT POINTS.

The few hints in regard to export matters given in last month's notes may be supplemented by a few general outstanding points in connection with the actual preparation of fruit for export. Colour standards must be rigidly maintained, even if the general run of fruit is lacking in colour. There is always a marked tendency to fall short as regards the colour standard on a dull line of fruit. Graders should occasionally make an examination of fruit in the bins to check

up their grading. Grade and pack should not be sacrificed for speed. The size of fruit should be uniform throughout a case; larger-sized fruits should not be used to bring up a low case, as this interferes with the pocketing and causes bruising. Corrugated strawboards are preferable to the ordinary cardboard pads for such varieties as Cox's Orange. Faulty cases should be discarded. Nails should be not less than 14 gauge and $1\frac{1}{2}$ in. in length. Paper of correct size should be used. Extreme care should be exercised in marketing cases—giving correct particulars. Wood-wool, where used, should not protrude from ends of lids. Marks on labels should be distinct and put on neatly. Red, violet, and green inks fade quickly; a black ink is preferable—care being taken to keep the pad sufficiently moist but not wet.

SPRAYING AND OTHER ORCHARD WORK.

The actual work in the orchard for the coming month will consist mainly in spraying late varieties of apples and pears with arsenate of lead for the control of codlin-moth and leaf-roller caterpillar, using $1\frac{3}{4}$ lb. to 100 gallons of water. Leaf-hopper may still prove troublesome, necessitating the application of Black Leaf 40, 1-800. Red mite may have increased considerably where lime-sulphur has not been the standard fungicidal spray throughout the season. Recently attention has been given to the use of special summer oils, chiefly for the control of such pests as red mite. Where such oils are procurable growers would be well advised to carry out tests on a small scale, and thus become acquainted with their use and effects. Ordinary spraying-oils have been applied at varying strengths in the summer with satisfactory results, and may be safer in their application than reverting to lime-sulphur on trees where red mite has reduced the vitality of the tree to any extent. Oil, 1-100, has been applied with safety, and to avoid a spotting of the fruit which may sometimes occur the addition of 4 lb. to 5 lb. of soap is recommended.

Trees should be looked over frequently for the purpose of adjusting props, putting in extra ones and tying to prevent, as far as possible, breaking of limbs and splitting of crotches. Consideration should be given to the necessity of permanently wiring-up trees. Possibly the work may be fitted in during the winter months, but in the meantime it will be wise to give the matter a little thought.

In connection with intended plantings and replacements it is now well to look ahead, and, having decided on varieties, place orders early.

Trees grafted in the spring should be looked over, and ties not already cut dealt with immediately to prevent any restriction in the sap. New growths often require some protection to prevent them being blown off by wind.

FIREBLIGHT.

There is still danger of fireblight infection occurring on shoots, which may lead to infection of main limbs, more particularly in

the case of pear-trees. Such varieties as Williams Bon Chretien and other varieties picked early may require an inspection occasionally.

—N. J. Adamson, *Orchard Instructor, Hastings.*

Citrus - culture.

From now on fruit-picking will form the chief current work. As the fruits become ready they should be removed from the trees and put in suitable storage for curing. The best period to harvest lemons is as soon as sufficient size has been attained and the leaf-green of the fruits gives place to silver-green. Fruits should be cut from the trees with one of the types of cutters designed to permit easy working without danger of piercing the rind. Really two cuts are necessary in harvesting lemons—one to sever the fruit with footstalk attached from the tree, and the second cut to trim the stalk back flush with the button, and so avoid the stem-puncture so common among fruits in the cases.

Fruits which have turned yellow, even though small, should be removed from the tree; allowing them to remain will not increase their size, juice contents, or market value. The main alterations which take place in such tree-refined fruits are increased colour of rind, fibrousness of ray and cell sacs, and development of stored food in pips. This is the factor which acts to the real detriment of the tree, as an unnecessary strain is put on its functioning. As fruits are harvested they will be found on three types of wood: (1) Young laterals with tip-flower extensions; (2) one-year-old laterals somewhat extended, worn out towards the extensions, but showing a vegetative shoot nearer the base; (3) two-year-old laterals very extended and worn out generally.

There are modifications, but these types serve to represent the necessary pruning to be done, which may with advantage be carried out at harvest-time when each individual fruiting lateral comes under close observation. (1) Young laterals may be left uncut, unless they are in an undesirable upright position or too numerous for what is considered the capability of the tree. (2) One-year-old laterals should be cut back beyond the worn-out part to a good bud on healthy green wood, or to a vegetative growth if present. (3) Two-year-old laterals should be cut out clean to the base. Even if there are not sufficient of types (1) and (2) to give an assured season's crop, profit will never come from laterals of type (3), which have become an encumbrance to the tree, many through not having been cut back as recommended for (2), and which otherwise would have given rise to useful side shoots. It is usually found that worn-out trees are hampered by a multitude of spent laterals. Should such be the case it is preferable to cut these laterals back to the base and keep the framework of the tree, rather than cut back the main limbs.

A general renovation of this kind gives more fruiting type of wood than the severe cutting, but it is of course more desirable to keep up a relay of wood such as is brought about by proper and regular attention to laterals at each fruit-picking time.

—W. H. Rice, *Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CULLING.

THE present high cost of foodstuffs, and the probability of having to accept lower prices for poultry products as compared with prices received during recent years, are sufficient indications that the poultry-keeper cannot afford to have on the plant any bird that will not produce heavily in the future. The coming month may be regarded as the best period of the year for culling out undesirable stock. In the first place every hen that shows signs of moulting and terminating its second season of production (with the exception perhaps of any noted breeding-specimens) should be weeded out without delay. Indeed, under existing conditions, drastic culling should take place in the majority of flocks after the pullets' first laying season. The day for keeping all birds for two years is past.

The culling of undesirable stock is one of the chief essentials in successful poultry-keeping. Of all operations connected with the business it is probably the most difficult to teach the novice properly by means of printed matter. However, to the man who is not a student of laying-form it may be pointed out that useful indications of poor laying-capacity in hens are early moulting, over fatness, and being above the normal weight of the breed; also any signs of weak constitution—such as dull eye, loose feathering, sluggish appearance, and lack of abdominal development—and anything denoting unhealthy condition.

The birds which have laid well and which are likely to do so in the future will present the following desirable signs of constitutional vigour and laying-power: Late moulting; face large and free from feathers (it is not uncommon for the head to become quite bare—a sign seldom or never found in a low producer); a bright prominent eye; close feathering; a bright red comb; a well-developed abdomen, which should be soft to the touch, a well-developed crop, and an alert, vigorous, but shabby appearance.

In yellow-skinned breeds the legs as well as the beaks of the good layers will mostly exhibit at this period of the year a bleached or even a white appearance, while, on the other hand, those of the poor layers will retain a more or less yellow colour. It may be mentioned that the legs of even the best layers will not become bleached out to the same extent when a grass range is provided as when they are kept in confinement. Here, as is the case with all matters connected with the management of poultry, local conditions must be taken into account when applying this test. The same may be said with regard to taking the time of moulting as a guide to productive capacity. It will be usually found that in a mixed flock of first- and second-season layers the latter will, owing to their shorter season of production, moult later than those in their pullet year. Therefore, in the work of culling due allowance for the age of the bird must be made, otherwise many of the young birds which it would be profitable to keep are apt to be disposed of, and their older but less profitable sisters retained in the flock.

In order to simplify the work of culling, all young birds should be marked in the web of the foot by a special punch made for the purpose.

EARLY MATURITY.

On a recent visit to a poultry plant the owner drew my attention to two lines of White Leghorn pullets of the same age—near five months—which were purchased from two different breeders as day-old chicks, and which had received similar treatment in all respects. In the case of one line the owner was high in his praises, merely because some of them had commenced to lay at such an early age. With the others both the stock and their breeder were condemned, as in this case the birds gave little indication of even nearing the laying stage.

It is to be feared that there are too many poultry-keepers who hold the mistaken idea that early maturity necessarily indicates heavy productive powers. It is true that some strains of the same breed, when subjected to similar treatment in every respect, will commence to lay at an earlier age than others, but this does not necessarily mean that the very early maturing bird is the most profitable to keep, nor has it yet been proved that such stock are desirable specimens to breed from.

As a general rule, when a pullet commences to lay she will not make further growth. Obviously her energy will be diverted to egg-production and not to bodily development—this meaning that the bird will never reach the standard size of its breed, nor will it lay a desirable-sized egg as does the bird which comes to lay when fully developed. For a bird to be a long-season layer of good-sized marketable eggs she should not commence her season of production until she is well developed and has reached an age of at least six months, and even that period may be extended in the case of the heavier breeds. It is not the age at which a bird commences to lay, but the number of eggs of good marketable size she will produce in two years and possess at the same time desirable breeding-power that determines her real value. The small egg is one of the greatest drawbacks confronting the industry to-day in the establishment of a sound export trade, and it is not the bird which comes to lay when it is little more than half-grown that will tend to improve matters in this respect.

SELECTING THE BREEDING-HENS.

If a uniform, heavy-producing flock is to be bred and maintained, it is of the first importance that nothing but purebred stock be placed in the breeding-pens. In doing this the poultry-keeper should be familiar with the characteristics of the breed or breeds he is working with. In other words, he must have an ideal type in his mind's eye, in addition to signs indicating productive capacity. Those who are not familiar with breed-type would be well advised to procure a copy of the New Zealand Utility Poultry Standards, obtainable from the Department of Agriculture, Wellington, at a cost of 3s., postage free. This contains plates showing breed-type combined with utility.

Having secured purebred stock and eliminated the drones from the flock, as previously advised, it must not be assumed that all the remaining birds on the plant are suitable for the breeding-pen. In selecting the best hens for this purpose it is not so much the egg-yielding capacity that should be studied as the power to produce desirable

progeny. It is always a good plan to choose for the breeding-pen a hen slightly larger than that desired in a laying-flock. The small birds will come soon enough without specially breeding for them. Unfortunately, too many poultry-keepers consider that because small birds are often good layers they must necessarily be desirable specimens for the breeding-pen. This is a great mistake, and the less it is practised the better will it be for the poultry-keeper's pocket and the industry generally. Furthermore, less would be heard of the necessity of having to unload small-sized eggs on to the London market. It should always be remembered that, as a general rule, the diminutive hen produces a low-grade egg. No hen should be placed in the breeding-pen which does not produce a standard-weight egg—namely, one of 2 oz.

I would again emphasize the importance of weeding out all inferior stock at the earliest possible moment, and also of selecting the breeding-stock, for the reason that the signs referred to as indicating high or low egg-capacity will vanish with the moulting process.

—F. C. Brown, *Chief Poultry Instructor, Wellington.*

THE APIARY.

FINAL EXTRACTING.

BEFORE taking the last of the surplus honey a careful examination of the colonies must be made in order to ascertain the amount of stores available for wintering the bees. Too often beekeepers err in extracting too closely, and feeding has to be resorted to at a later period to make up the amount required to prevent starvation. It takes 30 lb. of honey to winter a colony successfully, and if this amount is increased to 40 lb. there is less likelihood of the bees being short in the spring, while the beekeeper will also be saved a great deal of anxiety and endless trouble in the way of feeding.

Where extracting has been delayed for any reason it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care must be exercised not to incite the bees to rob by keeping the hives open longer than it is necessary to remove the surplus. A rapid examination of the brood-chamber should be made in case it is found that the bees have not filled the combs in the lower storey with honey. If empty or partly filled combs are found, it is highly important that they be replaced with good combs of honey from the super. On no account attempt to extract any honey from the brood-chamber. Do not leave combs lying about or expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to start the bees robbing in a wholesale manner.

EXTRACTED COMBS.

It is very bad practice to put extracted combs on the hives as soon as the honey is taken from them. If returned during the day in all likelihood robbing may be started, and, moreover, the

bees will become troublesome as they seek an entrance to the honey-house. The wet combs should be placed on the hives in the evenings, as the bees will have time to clean them during the night, and any excitement caused by the return of the combs will have subsided by morning. Owing to the labour involved in carrying out supers of combs, placing them on the hives, then freeing the combs of bees, and finally returning them to the honey-house, many beekeepers make a practice of storing wet combs. Although no definite research work has yet been undertaken to determine whether the following season's honey is affected by combs stored in this manner, it lends suggestions to a very doubtful procedure, for not only do the moist atmospheric conditions promote fermentation of the honey in the combs, but in the course of time honey-houses become permeated with the injurious bacteria of fermentation, while the sour smell engendered cannot be considered in any other light than detrimental to the keeping-qualities of a well-ripened honey.

It may be well to remind beekeepers that many lines of honey, while not actually sour or in a fermented condition, possess the characteristic odour so very noticeable in rooms used for storing wet extracting combs. The keeping-qualities of such honey are regarded as doubtful, and it is rejected for export. While beekeepers may be producing the maximum crops attainable under the season's conditions, the after-care of the honey, once in the storage-tanks, presents quite a number of problems, not the least important of which is the preservation of its natural aroma.

BEESCAPES.

For removing honey late in the season the beekeeper may find it necessary to bring into use bee-escapes. These escapes enable the honey to be removed without causing any disturbance. By the employment of the Porter bee-escapes there is less likelihood of causing robbing, with its attendant evils. More especially will the escapes be found advantageous when removing section honey from the hive. There is far more risk in removing comb honey from the hive than extracted honey. When the colony is disturbed the bees will at once start to fill their sacs, and often the cappings of the sections are punctured in order to secure a supply of honey. The damage to the cappings of sections is unsightly, and causes the honey to leak after removal from the hive.

The best escape device is made in the form of a frame 20 in. long, 15 in. wide, by 3 in., which is covered by wire gauze, and one or two escapes fitted into it. In inserting the escape gently prize up the super from the brood-chamber and insert the board. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will pass through the escape during the night to the brood-nest, and will be unable to return. In the morning the supers may be removed, when practically no bees will be left in the super.

A word of caution to those who have not formerly used the escapes: Should there be brood in the super combs the bees will not leave, and the escapes will not prove effective in ridding the

supers. Over and over again many beginners complain that they cannot get the bees to leave the supers when using escapes; but the reason lies in the fact that no examination had been made to ascertain beforehand whether the super contained honey only.

UNITING COLONIES.

Among the autumn work to be attended to is the examination of the colonies for the purpose of ascertaining if each possesses a laying queen, and to note those that are too weak to survive the winter. In the negative in either case it is advisable to unite with a stronger colony to save the bees. On no account should an attempt be made to winter weak hives, as they are likely to get robbed out, and this may cause the bees to start robbing generally when everything in the apiary should be quiet.

—E. A. Farp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

THE later tobacco crops will now be ripening, and the leaf should be gathered as soon as the middle leaves on the stalk show the requisite signs of ripeness. An early harvest has the additional advantage of warm curing-weather, which is a great facility. This advantage should be taken by carefully observing the ripening process and the weather, and accepting the best conditions offering without delay.

Give the leaf careful consideration while it is air-curing; ventilation and humidity must be carefully watched throughout the process. In rough weather the ventilators will require to be closed down to avoid chilling and bruising the leaf; in warm close weather more ventilation will generally be required. This is often deficient in the gables of the roof, and many barns would afford much better results if more ample ventilation were available there. The worst dangers threaten later in the season, when cold damp weather is experienced. The leaf must be kept warm, and any temperature much below 60° F. will cause mildew and decay.

When the leaves are cured and thoroughly dried out the plants must be taken down and the leaves stripped from the stalk, graded, and tied in "hands." The grading must be done in accordance with market requirements. Keep the grades separate and tie the leaves—fifteen to twenty together—by the stems in a bunch (hand), with a leaf of tobacco folded bright side outermost. Commence binding with the tip and finish by bringing the butt of the stem of the binder back close up to the binding between the layers of the hand of leaves. Most important is it that the leaf is in a soft pliable condition when this or any other handling process is carried out. Much damage is done every season by handling leaf in a dry state, when it breaks easily, and its value is heavily discounted. The dry leaf absorbs moisture very readily, and if by means of steam or some other method a humid

condition is created the requisite condition of the leaf is very quickly brought about, after which it may be handled without damage.

As the leaf is graded and made up into hands it can be bulked ready for baling up later. During this stage, if it is likely to be exposed to cold or drying conditions, it should be wrapped in waterproof covers. Tobacco is a very sensitive product, and the fine qualities are only developed and retained when it is handled with care.

BERRY FRUITS.

In some cases this season numbers of strawberry-plants have borne little fruit, owing to debility caused by an absence of good normal foliage that is so necessary for the proper functioning of the plant. Leaf-spot (*Mycosphaerella*) has so increased that the whole of nearly every leaf is discoloured and curled, till the whole plant is a tight bunch of bronze-coloured foliage. This may be readily avoided by periodical sprayings during the early summer months with bordeaux. Such a spray will also do very much towards cleaning up the plants generally, and assist in reducing the fruit-rot that is sometimes too prevalent. Berries found affected in this way must not be thrown on the ground, but should be collected when picking and destroyed. Excessive moisture due to atmospheric conditions or lack of drainage are the conditions that encourage the development of this mould.

With the harvest season over the cleaning-up of the beds should be carried out without delay, and such spraying as needed should be done. Loganberries, like raspberries, should have the old fruiting-canes and weak shoots removed. The fruiting-canes for next season may then be given any necessary spray treatment required, tied in, and ripened in readiness for another season. All of these summer-bearing berry plants should now be put into good heart during the autumn months.

TOMATOES.

Among the outside tomato crops one or two cases of "early blight" have been observed. Fortunately this disease is not general, but it is rather stubborn to deal with when found. We are now told that the fungus known as *Alternaria* is not the causal organism, as has been stated, but is incidental. This disease is to receive more attention shortly from those who make a special study of fungi, and we may look forward to more enlightenment as to the ways of this troublesome organism, which may lead to a more effective method of preventing the serious damage for which it is sometimes responsible.

MARKET-GARDEN CROPS.

Perennial crops such as rhubarb and asparagus should now be making strong growth, and if they are also well protected from severe winds this condition should promise well for the spring crop.

The winter crops of savoy cabbage, cauliflower, broccoli, leek, and celery planted out in January have had good weather and should now be well advanced. They are all crops that like generous treatment, and where any are backward a little sulphate of ammonia or nitrate may be given to stimulate growth.

Commence to mould up the main-crop celery for blanching. The soil must be friable and the plants free from surface moisture. Draw the mould only a few inches high at first, and increase it after a week or ten days, making about three operations of the process. Where small quantities in trenches are being grown see that the needs of the plants in the way of food and water are well supplied before moulding up is commenced.

Cabbage crops for spring cutting are planted out towards the end of March, or rather later in northern districts. For this crop an area from which potatoes or peas have been recently harvested is very suitable. Light cultivation is all that is needed, and when the surface is even and firm mark it out into shallow drills and set out the plants. A dressing of lime will be of great assistance, and help to keep the plants from the attack of pests. In fact, if the plants are sprayed while in the seed-beds with bordeaux and arsenate of lead they will be well protected from insects as well as fungus enemies.

The big onion crops in this country are grown on the fine, rich, light soils of the drained swamps of North Canterbury, where the rainfall is light; and also to a considerable extent on the warm slopes of Pukekohe Hill, near Auckland. In such localities the dry climate enables spring-sown crops to ripen and be harvested in good condition, but in districts with a heavier rainfall, or where a dry autumn cannot be relied on, it is the practice to gain time by sowing the seed in the autumn, planting it out in early spring, and so bringing the crop to maturity in the drier summer months instead of the late autumn. The crop thus finishes in better condition, and is less liable to losses from mildew disease. Seed may be sown now on a piece of clean well-drained soil. Firm the ground and sow thinly.

Feed late crops of peas, and runner and dwarf beans, &c., so that there may be no delay in bringing them into bearing while there is time to take a crop from them before winter.

THE HOME GARDEN.

In most districts garden-making or alterations are best completed during the present month, and preparations made for planting trees and shrubs in the months of May and June. Grass-seed sown now will make a nice sward before the winter; or where turf is laid it will quickly establish itself. A good application of blood-and-bone manure, turned well in, makes an excellent dressing, and where grass-seed has to be sown or turf laid the ground must first be made evenly firm and the surface smooth, special care and plenty of time being given to such preparation. Avoid depressions and hollows that will hold surface water; in fact, care should be taken to see that the surface inclines in such a manner that all flood water is conveniently led away. For that reason level lawns are difficult, and should only be made when specially required for games. In this manner green lawns, which are by no means the least attractive feature in the garden, may now be established with the least trouble and best chances of success. Sow thickly; 1 oz. of seed of ordinary lawn mixture to 2 sq. yd. is a suitable quantity.

—W. C. Hyde, *Horticulturist, Wellington.*

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

FIFTY-SEVEN certificates were issued under the C.O.R. system in January. Details of the records are given in the following list:—

* Cow milked three times daily during whole lactation period † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season		
				Days	Milk	Fat.
JERSEYS.						
Junior Two-year-old		Yes, dys	lb.		lb.	lb.
Waipiko Joy Queen ..	C. G. C. Dermer, Waipiko	1 304	240·5	305	10,185·8	604·00
Waipiko Clandestine ..	C. G. C. Dermer, Waipiko	1 282	240·5	305	11,477·6	573·60
Likeness Dainty ..	H. N. Svendsen, Pukekohe	2 82	248·7	305	10,278·4	517·49
Waipiko Coral ..	C. G. C. Dermer, Waipiko	1 327	240·5	305	8,367·8	402·20
Greendale Molly ..	R. J. Johnston, Runciman	2 68	247·3	305	7,671·6	455·67
Croydon Princess Joan ..	W. Crosby, Waipuku	1 354	240·5	352†	8,109·6	440·52
Vernon Golden Freezia ..	D. J. Cooper, Masterton	1 330	240·5	305	8,670·2	438·21
Masterful's Remembrance	A. Devine, Tamahere	1 288	240·5	305	8,939·7	434·40
Marshlands Coral ..	W. J. Chynoweth, Pukeroro	1 292	240·5	305	7,319·0	423·13
Lady Hignett ..	Mrs. M. North, Ohauapo	2 72	247·7	324	7,460·4	389·23
Huimai Miss Prim ..	J. Nicholson, Manakau	1 350	240·5	340	8,593·9	388·38
Woodlands Lady Ethie	H. C. Sampson, Hillsborough	1 337	240·5	305	7,101·3	381·58
Marshlands Expectation	W. J. Chynoweth, Pukeroro	2 17	242·2	304	7,061·1	375·65
Silverleys Oxford Rita	J. S. Jones, Bell Block	2 42	244·7	318	6,953·6	359·93
Jersey Lea Petal ..	R. C. Leach, Woodville	2 11	241·6	305	6,404·0	340·45
Silverleys Lady Viola	J. S. Jones, Bell Block	2 3	240·8	319	5,644·3	337·44
Senior Two-year-old.						
Vernon Golden Lily ..	D. J. Cooper, Masterton	2 331	273·6	305	9,244·3	522·38
Ribbonwood Nettie ..	C. G. Bloore, Gisborne	2 346	275·1	282	5,776·6	277·48
Three-year-old						
Waipiko Cosmetic ..	C. G. C. Dermer, Waipiko	3 304	307·4	305	10,595·1	622·87
Silverleys Malaprop ..	J. S. Jones, Bell Block	3 356	312·6	305	9,311·7	578·35
Silverleys Oxford Wonder	J. S. Jones, Bell Block	3 4	277·4	302	8,226·4	492·65
Ohape Lavender ..	H. W. Birch, Roxburgh	3 32	280·2	305	6,028·5	381·82
Huimai Podge ..	J. Nicholson, Manakau	3 33	300·3	243	7,944·8	333·11
Holly Oak Comedy Queen	L. A. McDonald, Levin	3 247	301·7	189	6,344·8	331·70
Four-year-old.						
Falconite Pansy ..	G. E. Yelchich, Waiuku	4 27	316·2	305	11,383·9	593·54
Vernon Cherry Bloom	G. R. and H. Hutchinson, Auckland	4 331	346·6	305	10,806·1	584·27
Waipiko Jewel ..	C. G. C. Dermer, Waipiko	4 242	337·7	350	10,299·6	582·97
Queen Myrtle* ..	W. Craig, Waiuku	4 164	329·9	305	11,605·8	578·50
Swan's Fox's Fancy ..	D. J. Cooper, Masterton	4 183	331·8	361	10,676·2	545·67
Vernon Rata ..	D. J. Cooper, Masterton	4 204	339·9	305	10,024·3	537·04
Woodlands Lily ..	H. C. Sampson, Hillsborough	4 285	342·0	305	10,021·3	524·03
Tauwhare Princess ..	Dr. C. G. Aickin, Auckland	4 21	315·6	304	9,595·0	510·91
Waipiko Casuarina ..	C. G. C. Dermer, Waipiko	4 321	345·6	305	9,587·9	481·60

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—*continued.*

		Yrs. dys.	lb.		lb.	lb.
<i>Mature.</i>						
Marshlands Leno ..	T. Smith, Otorohanga ..	5 14	350·0	365	12,044·7	701·38
Waipiko Lorna ..	C. G. C. Dermer, Waipiko	7 299	350·0	365	13,634·0	672·08
Yarrawa's Girl ..	J. S. Jones, Bell Block ..	8 302	350·0	365	10,452·0	664·35
Holly Oak Sage Queen	T. A. Jennings, Mauriceville	6 216	350·0	365	11,226·9	587·75
Cid's Distraction ..	Dr. C. G. Aickin, Auckland	6 207	350·0	364	7,487·1	478·38
Vernon Fuchsia ..	D. J. Cooper, Masterton ..	5 62	350·0	278	8,418·6	450·30
Meadowvale Empress	L. A. McDonald, Levin ..	6 44	350·0	189	6,715·7	354·55

FRIESIANS.

<i>Junior Two-year-old.</i>						
Echo Sylvia Pietertje Topsy*	Fraser and Kirkness, Wai-kiwi	2 22	242·7	333	13,809·1	465·37
Pareora Hero Posch*	A. S. Elworthy, Timaru ..	2 136	254·1	297	13,168·6	440·19
Totara K. P. Lena Lass 2nd*	Piri Land Co., Auckland	2 69	247·4	326	13,835·3	437·16

<i>Senior Two-year-old.</i>						
Wescoll Natalie* ..	Wesley Training College, Paerata	2 355	276·0	365	12,615·3	510·52
Totara Paula Kate*	Wesley Training College, Paerata	2 270	267·5	365	11,663·1	436·70
Dominion Queen Crest	Central Development Farm, Weraroa	2 334	273·9	365	11,530·0	377·95

<i>Mature.</i>						
Daisy Segis of Norfolk Park*	Wesley Training College, Paerata	9 229	350·0	365	20,792·5	649·92
Pareora Janette* ..	A. S. Elworthy, Timaru ..	7 70	350·0	365	19,666·2	616·37
Bainfield Sylvia Ideal*	C. H. Potter, Pukerau ..	5 338	350·0	365	17,551·9	578·51
Dominion Kruger's dorp	Central Development Farm, Weraroa	7 37	350·0	365	14,894·6	474·00

AYRSHIRES.

<i>Two-year-old.</i>						
Elims Kowhai ..	A. R. Claridge, Toko ..	2 170	257·5	250	7,780·7	323·22

RED POLLS.

<i>Two-year-old.</i>						
Dominion Beulah ..	Central Development Farm, Weraroa	1 356	240·5	365	7,598·7	300·01

Second-class Certificates.

Jerseys.

<i>Junior Two-year-old.</i>						
Ku Ku Virtue ..	F. Phillips, Otorohanga ..	1 355	240·5	365	9,052·1	488·21
Tyntesfield Eunice ..	R. K. Garland, Okauia ..	1 355	240·5	365	7,217·6	473·93

<i>Three-year-old.</i>						
Waiora Charm ..	A. E. Peppercorn, Cambridge	3 48	281·8	365	9,023·8	441·91

<i>Mature.</i>						
Willowbank Wonder	J. S. Jones, Bell Block ..	9 356	350·0	365	11,105·7	574·11

Friesians.

<i>Junior Two-year-old.</i>						
Totara Busate Rose*	Piri Land Co., Auckland ..	2 25	243·0	365	15,413·7	611·08

WEATHER RECORDS : JANUARY, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

JANUARY was a month of contrasts, a hot spell in the third week being followed by a cold snap of almost wintry severity. Rainfall was considerably below average in the North Island and the western districts of the South Island, but in Canterbury and Otago an excess was generally recorded. Once more there was an unusual frequency of thunderstorms, many of which were severe. In some cases these storms were accompanied by downpours resembling miniature cloudbursts. Some remarkable hailstorms also occurred, considerable damage being done in a number of instances.

The storm systems were mainly centred far south, and of only moderate intensity. In consequence, the prevailing weather was of the westerly type, and the storms affected principally the South Island. High-pressure centres continued to follow unusually far-northward tracks for the season of the year, but were seldom of any great intensity.

The deficiency of rainfall, following on the heavy rains of December, was not enough in the North Island to affect pastures adversely, and feed is everywhere abundant. The rankness of the growth has in places adversely affected the raising of fat lambs, but stock is on the whole in good condition. The hot, dry weather preceding the 20th was a boon to harvesters and hay-makers, and satisfactory results are generally reported. Some crops have been flattened by wind, hail, or rain, but fungus diseases have made much less headway than was feared.

A very severe hailstorm, in which stones up to 2 in. in diameter were seen to fall, visited Otago on the 7th during the passage of a low-pressure wave. A number of crops were totally destroyed and other damage was done. On the 8th a deep depression was centred south of Tasmania, the Hobart barometer reading 28.96 in. North-westerly gales were experienced in and south of Cook Strait on this day and the next. On the 10th a terrific thunderstorm, accompanied by torrential rain, occurred near the Hermitage, some miles of road being washed out.

The week ending on the 19th was very hot, many places in the South Island recording over 90 F. In the North, though temperatures were not so high, the great humidity rendered conditions no less oppressive. Hawke's Bay, however, appears to have escaped much of the severity of this heat wave.

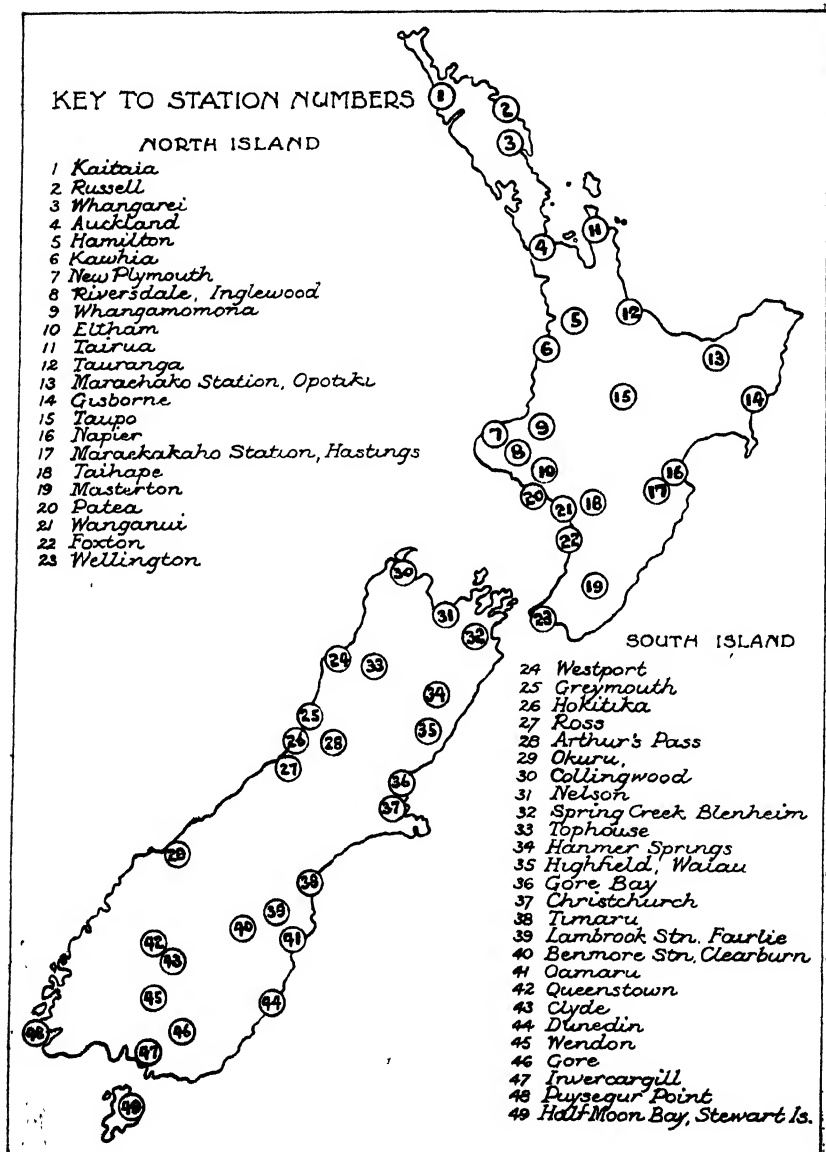
The hot spell was followed by a period of southerly winds, which gradually increased in force and brought lower and lower temperatures. An anti-cyclone was centred over the Tasman Sea, while pressure fell very low to the eastward. On the afternoon of the 23rd Chatham Islands reported a barometer reading of 28.78 in. The southerly winds began to reach gale force in places on the 22nd, but did not attain their full strength until the night of the 24th and the morning of the 25th. Most districts then experienced gales, but from Cook Strait southwards on the east coast they were exceptionally severe. The high winds, accompanied by high tides and a heavy swell, caused unusually rough conditions. Shipping was delayed and some vessels reported damage. Some of the eastern suburbs of Christchurch were flooded, and the Wellington to Petone railway was again undermined in places. Snow fell on the high country on the 23rd and 24th, and severe hailstorms were remarkably widespread. By the 25th the weather was extremely cold, some stations even recording frost. From the 26th conditions gradually returned to normal.

The month has been remarkable for disturbed conditions in the tropics. In the interior and north of Australia pressures were most unusually low, monsoonal conditions being strongly developed. Between the 18th and the 23rd the low-pressure conditions extended across the Pacific to beyond Samoa. At least two cyclonic centres developed—one near the New Hebrides which ultimately passed close to Suva, where the barometer fell to below 28 in.,

and the other near Samoa. It is probable that there were two separate centres in the latter. Fortunately, the damage done was not severe.

Edward Kidson, Director of Meteorological Services,

Wellington, 7th February, 1929.



MAP SHOWING NEW ZEALAND RAINFALL STATIONS COMPRISED IN *Journal* LIST.

RAINFALL FOR JANUARY, 1929, AT REPRESENTATIVE STATIONS.

No.	Section.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
<i>North Island</i>					
		Inches.		Inches.	Inches.
1	Kaitia	1.52	7	0.40	3.36
2	Russell	0.43	5	0.18	4.11
3	Whangarei	1.63	9	0.45	4.08
4	Auckland	1.38	11	0.69	2.66
5	Hamilton	1.53	11	0.42	3.94
6	Kawhia	2.10	10	0.50	3.52
7	New Plymouth	1.64	11	0.39	4.42
8	Riversdale, Inglewood	2.69	12	0.99	7.43
9	Whangamomona	2.47	5	0.79	6.05
10	Eltham	1.60	10	0.55	3.92
11	Tairua	0.82	8	0.24	4.35
12	Tauranga	1.18	10	0.29	4.34
13	Marachako Station, Opoitiki	0.96	6	0.46	4.29
14	Gisborne	2.82	5	1.70	2.97
15	Taupo	0.95	6	0.31	3.71
16	Napier	0.85	8	0.57	3.18
17	Marachakaho Stn., Hastings	1.02	16	0.86	2.29
18	Taihape	4.38	15	1.09	3.28
19	Masterton	2.48	9	0.80	2.69
20	Patea	1.28	8	0.34	3.79
21	Wanganui	1.78	6	0.67	2.87
22	Foxton	1.65	7	0.96	2.30
23	Wellington (Karori)	2.64	15	0.88	3.31
<i>South Island</i>					
24	Westport	4.00	18	0.70	6.80
25	Greymouth	6.84	18	1.02	9.03
26	Hokitika	9.06	18	1.78	9.87
27	Ross	13.08	11	3.28	12.04
28	Arthur's Pass	20.05	15	8.96	9.36
29	Okuru, Westland	10.80	14	1.90	12.86
30	Collingwood	4.52	12	1.70	6.95
31	Nelson	1.01	6	0.36	2.82
32	Spring Creek, Blenheim	1.77	10	0.55	2.22
33	Tophouse	4.75	13	1.25	5.14
34	Hannier Springs	3.43	13	0.99	3.74
35	Highfield, Waiau	3.92	10	1.10	2.95
36	Gore Bay	2.65	11	1.11	2.71
37	Christchurch	4.07	11	1.47	2.21
38	Timaru	1.34	13	0.24	2.30
39	Lambrook Station, Fairlie	0.92	11	0.20	2.38
40	Benmore Station, Clearburn	3.44	12	1.48	2.77
41	Oamaru	2.30	15	0.44	2.11
42	Queenstown	4.37	13	1.22	2.72
43	Clyde	1.82	9	0.69	1.72
44	Dunedin	4.41	17	0.64	3.36
45	Wendon	4.97	12	1.40	3.22
46	Gore	4.07	16	1.00	3.09
47	Invercargill	5.52	21	1.30	4.01
48	Puysegur Point	8.34	20	1.62	7.22
49	Half-moon Bay, Stewart Is.	5.74	21	1.15	4.68

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SHEEP-DIPPING POINTS.

“INQUIRER,” Havelock :—

(1) Please advise me as to what period of time should elapse between the dosing for worms and the dipping of lambs, hoggets, or full-grown sheep. (2) If dipped ewes are put to the ram in mid-March, can you advise me as to the safest period to again dip such pregnant ewes?

The Live-stock Division :—

(1) At least ten days should elapse between dosing for worms and the following dipping. This applies equally to lambs, hoggets, or full-grown sheep. If the dose contains arsenic and the dipping-fluid is also arsenical a longer period (three weeks) should be allowed. (2) Pregnant ewes can be dipped, if the operation is carried out with care, during the first four to six weeks of pregnancy.

PROPAGATION OF WALNUTS.

O. R. BOSTOCK, Fernhill :—

Will you please tell me the best way to propagate walnuts from a choice tree? I should say by budding, as I think the trees would bleed too much when cut off for grafting.

The Horticulture Division :—

The propagation of walnut-trees by top-working has been very little practised in other countries until during recent years. A method often adopted is to bud young seedling plants about the month of February. Patch-budding is the method most commonly followed, and the incision is made near the surface of the ground. It is essential to ripen the bud by removing the leaf, leaving the leaf-stem attached to the base of the bud for a period of about ten days before the buds are cut. After placing them in position the buds must be carefully and firmly bound with wax cloth and the development watched. They should be allowed to remain dormant over the winter, and the binding removed before it causes restriction. Where the grafting method is used one-year seedlings are cut back just before they commence growth in the spring. The surface soil is hoed to a depth of 2 in. to 3 in., and the scion is inserted, by means of whip grafting, just below the surface of the ground. Tie the graft in position, and thoroughly wax the union and top of the scion, then hoe the soil back, covering the scion to a depth of 1 in. or 2 in. Long light stakes should be used to train the young growth and prevent it being broken out.

NASAL CATARRH IN DAIRY CATTLE.

“JERSEY,” Waitara :—

Kindly inform me whether there is any known cure for nasal catarrh in milking-cows or weaner calves. Is the trouble common?

The Live-stock Division :—

Nasal catarrh in milking-cows or calves is not a serious affection—in fact, is such that a number of owners pay very little attention to it. Catarrh of the nasal mucous membrane may be caused through irritation of the passages by dust or foreign bodies. In isolated cases of catarrh foreign bodies in the passages, such as small sticks, should always be looked for. Many cases of nasal catarrh in cattle are reported during the warmer months of the year, which invariably disappear at the approach of colder weather without any treatment whatever. This seasonal occurrence of the complaint, without any evidence of foreign bodies

as a causal agent, would suggest that the complaint is analogous to hay-fever in the human subject. It has also been noted that certain families in a herd are more susceptible than others. As regards treatment, the nasal passages require to be carefully syringed out with a solution of boric acid and water, or with normal saline solution. Such weak antiseptic solutions will help in allaying the irritation and assist recovery.

SALT SPRAY FOR KILLING GORSE.

“OVERGROWN,” Wellington :—

In the *Journal* for October the Fields Division advises the use of a salt spray for the eradication of gorse. Kindly explain further—(1) Would the spray kill fully grown gorse? (2) Should the gorse be cut previous to the applications? (3) At what season would the spraying be most likely to be effective?

The Fields Division :—

(1) One spraying will not kill the gorse; generally two or more are necessary. Big gorse is, as a rule, easier to kill than small stuff. (2) It is more effective to spray the standing gorse; cutting and spraying at once would not be effective with a salt solution. (3) Spraying is most effective in the summer, when the gorse is in full seed.

WARTY GROWTHS ON COW'S HEAD.

“SUBSCRIBER,” Dannevirke :—

My house cow has within the last two months developed growths about the size and shape of small marbles, hard and of a pink colour, bunched together on her chin and lower part of the jaw. They have the appearance of warts, but as they may be malignant growths I should be glad to know what the trouble is, and if one ought to use the milk for the house. The animal is a first calver and in good general condition.

The Live-stock Division :—

The growths described by you are not likely to be of a malignant nature. From their situation, and considering the age of the animal, in all probability they are of the nature of papillomata (warts). We would recommend you to have the animal examined by your local Inspector of Stock, who will inform you regarding the milk-supply. If only warts are present it is quite safe to use. Such growths are best removed by some one with a knowledge of surgery, but as they do not interfere with the cow's condition their removal is at present not desirable.

AN ERRONEOUS STATEMENT.

In September last a New Zealand monthly pastoral paper published an article, based on news from Argentina, regarding the slaughter in that country of a pedigree bull which was stated to have been affected with foot-and-mouth disease on arrival from Britain. A paragraph to this effect quoted in the article was apparently from the *Review of the River Plate*. That publication, however, has since corrected its original report of the case with a statement that the animal in question was slaughtered owing to tuberculosis, and was not affected with foot-and-mouth disease. In conveying the facts of the case to the New Zealand Government authorities, the English Ministry of Agriculture states that it knows of no case in which foot-and-mouth disease has been carried to another country by means of an animal shipped from Great Britain.

Commercial Orchards.—An aggregate area of nearly 500 acres was planted in commercial orchards during the 1928 planting season in the various fruitgrowing districts.

ESTIMATED YIELDS OF WHEAT, OATS, AND BARLEY.

THE following estimated average yields per acre of wheat, oats, and barley for the season 1928-29 have been compiled by the Census and Statistics Office from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 6th February :—

District.				Wheat. Bushels per Acre.	Oats. Bushels per Acre.	Barley. Bushels per Acre.
North Island	..	..	..	33·94	40·88	35·86
Nelson	..	..	..	25·07	30·00	29·01
Marlborough	..	..	..	27·40	35·91	30·00
Canterbury	..	..	..	33·53	44·53	35·84
Otago	..	..	..	29·99	38·77	35·33
Southland	..	..	..	36·17	45·48	37·74
Average (estimated) for the Dominion, season 1928-29				33·06	43·45	34·49
Average (actual) for the Dominion, season 1927-28				36·56	43·66	40·87

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 8,400,000 bushels, as against an actual yield of 9,541,444 bushels for the season 1927-28.

The percentage of oats threshed for the five seasons ending with 1927-28 was 26·76 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 3,500,000 bushels, as against an actual yield of 3,852,687 bushels for the season 1927-28.

The percentage of barley threshed for the five seasons ending with 1927-28 was 98·03 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 750,000 bushels, as against an actual yield of 861,985 bushels for the season 1927-28.

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates for the remainder of the season have been notified by agricultural and pastoral associations :—

Taranaki Metropolitan Agricultural Society : New Plymouth, 6th and 7th March.
 Morrinsville A. and P. Society : Morrinsville, 13th March.
 Hawke's Bay A. and P. Society (Autumn Show) : Tomoana, 20th March.
 Mayfield A. and P. Association : Mayfield, 23rd March.
 Methven A. and P. Association : Methven, 27th March.
 Flaxbourne A. and P. Association : Ward, 18th April.

BOOKS RECEIVED.

AGRICULTURAL RESEARCH IN 1927 (Royal Agricultural Society of England).
 John Murray, London. Price 1s.
 CO-OPERATIVE MARKETING OF AGRICULTURAL PRODUCTS. By Michael Murphy,
 University College, Cork. Longmans, Green, and Co., Ltd., London.
 Price 3s. 6d.
 THE SCIENTIFIC PRINCIPLES OF PLANT PROTECTION. By Hubert Martin, South
 Eastern Agricultural College, Wye, Kent. Edward Arnold and Co., London.
 Price 21s.
 MASSEY AGRICULTURAL COLLEGE CALENDAR FOR 1929. Palmerston North; N.Z.

The New Zealand Journal of Agriculture.

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No. 3.

SOME ASPECTS OF IRRIGATION FARMING IN CENTRAL OTAGO.

PROGRESS OF THE GALLOWAY DEMONSTRATION FARM.

R. B. TENNENT, N D D., Fields Superintendent, Dunedin

FARMING in Central Otago, where carried out under irrigation, presents many problems and more complexities than confront those farmers operating under normally humid conditions. Wherever irrigation is practised it can be assumed that the cost of production must be relatively high, the very application of water in itself entailing a considerable expenditure in time and labour. It naturally follows that in considering the utilization of irrigated country the aim must be the adoption of that type of farming which will not only keep labour at a minimum, but will at the same time give commensurate returns per acre.

Broadly speaking, there are two main groups of irrigation farmers in Central Otago. The larger group is dependent upon the returns obtained wholly from irrigated country; farmers of the second and probably more prosperous group have a portion of their properties under irrigation, this being utilized largely for the production of winter feed enabling the wintering of a greater number of sheep. There is no question that this second class has been greatly benefited by irrigation, and probably no type of irrigation farming has proved more valuable when viewed in regard to its ability to increase the earning-capacity of run country. However, only a small proportion of our irrigated country can be utilized in this manner; the greater part of the land is divided into self-contained blocks wholly supplied with irrigation water, the owners of these farms being dependent solely upon irrigation for their incomes.

In viewing the prospects of making a successful livelihood from such areas it must be recognized that no one type of farming can be recommended. The chief consideration, which almost invariably determines the class of farming primarily adopted, is the natural bent of the farmer himself, and often it is only after passing through many

vicissitudes and periods of instability that he finally reverts to the farming practice most suited to the soil-conditions of his farm, its aspect, elevation, and water-supply.

There is no doubt whatever that considerable extension of fruit-growing will eventuate on the irrigated country, and it is quite obvious that satisfactory incomes have already been derived thereby in the more favoured localities. It is not to be assumed that the bulk of the land in Central Otago suited to orcharding has already been devoted to that purpose. Many well-favoured situations still remain to be developed to a much greater extent than at present, and it is safe to say that the ultimate success and future prosperity of our irrigation communities will be largely concerned with the economic development of the fruitgrowing industry. Accordingly its stimulation by all possible means should be steadily kept in view. Apart from suitability of location, the extension of fruitgrowing as a means of securing a satisfactory livelihood depends largely on an expanding market and the economic utilization of surplus fruit in a preserved or dried form.

Unfortunately, in the past some areas unsuited to orcharding have been planted, with the result that to-day in certain sections a considerable number of trees have been rooted out and the orchards sown down to grass and lucerne. When it is realized that, comparatively speaking, only a small proportion of the irrigated country of Central Otago is suited to the growing of stone or pip fruits, the necessity will be appreciated for those farmers situated on sections not ideally suitable for orcharding to direct their farming activities in some other direction.

The question of growing cash crops on irrigated country is one which at present merits little consideration. Cereal-growing is obviously out of the question on account of the annual and consequently recurring labour costs entailed, and it would appear that of all farm crops the potato and onion crops are the only two which will repay the cost of irrigation and secure fairly remunerative returns. There is no question that small irrigated farms solely devoted to lucerne-growing for hay will in course of time be a payable type of farming for many small holders to adopt. The production of lucerne hay could, of course, not be increased indefinitely, and can only be regarded as practicable where labour is available and the farm situated in close proximity to the railway.

Generally speaking, the type of farming which must ultimately be adopted by farmers on moderate-sized sections is that devoted to the growing of grass and lucerne for the production of animal products. Consideration has been given to the raising of sheep on small sections, and probably for a few years a single person can earn more for his labour from sheep than he can from cows. It is easier for him to handle at least twice as large an area as the dairy-farmer, from the fact that his winter provision is easier to deal with, and the actual irrigation of his grassland need not be carried out in the same thorough manner as is necessary on a dairy-farm. The chief drawback to this type of farming under irrigation is that the sheep become so affected with foot-rot when confined solely to irrigated pastures that before long it is found impracticable to intensively work the farm with this class of stock.

Dairy-farming will undoubtedly play a most important part in the development of Central Otago, in so far as the small animal-product farms are concerned—largely on account of the fact that cows in general give a higher per-acre return than other classes of stock. This fact must automatically make dairying the type of farming most capable of yielding a satisfactory income off a small holding.

Galloway Irrigation Farm.

It is opportune to here briefly survey the work carried out on the Galloway Irrigation Farm, from the point of view that it affords an excellent illustration of the ability of arid country to be converted into first-class dairying-land. When taken over by the Department of Agriculture* this area of 148 acres was in a denuded condition, scabweed, hair-grass, desert poa, and sorrel being the chief forms of vegetation on the land. Of the total area 90 acres are now under irrigation, and it is only this acreage that need be considered in relation to the development of dairying on the Galloway Farm; the remainder of the land, being situated above the race, is unirrigable, and hence worthless from the point of view of affording pasture for cows.

Dairying operations proper were commenced in the season of 1924-25, but prior to that year considerable initial development had taken place in regrassing the farm and in sowing down lucerne for winter hay. One of the principal drawbacks to a dairy-farm under irrigation is the fact that in commencing operations on a virgin block the farmer is immediately faced with the necessity of sowing down grass for summer feed, and at the same time he must make provision for winter hay by the growing of lucerne. This entails time and the expenditure of money, and in this respect irrigation farmers are handicapped compared with those farming under conditions of higher rainfall.

In 1924 18 acres of lucerne and approximately 40 acres of grass had been established, and dairy-farming was commenced with thirteen cows. The principal object of the farm was to ascertain the adaptability of cows to irrigated country, and to find out its carrying-capacity, in addition to determining the yield per acre of butterfat which might reasonably be expected from an average herd pasturing thereon. One of the chief aims, which has been rigidly kept in view, was to approach as nearly as possible to the conditions under which the average farmer might be working, and to this end all cows purchased for the farm were what could be regarded as ordinary animals. The herd in the main is composed of Ayrshires, with few outstanding cows. The slowness of this breed in reaching maturity renders its suitability for irrigated country open to question in some respects, but in all probability this characteristic is outweighed by the ability of Ayrshires to successfully withstand the rigorous conditions experienced during the cold winter months.

The growth of the herd has naturally been in direct relation to the carrying-capacity of the farm, and has steadily improved year by year. It is of interest to tabulate the progress in carrying-capacity from 1924

* A full account of the establishment of the Galloway Irrigation Farm and its initial operations was published in the *Journal* for October, 1926.

until the present season, bearing in mind that all winter feed used is grown on the farm. Particulars are as follows :—

Stock.			1924-25.	1925-26.	1926-27.	1927-28.	1928-29.
Milking-cows	..		13	28	38	46	56
Heifers	..	..	..	4	7	12	14
Calves	..	..	12	16	12	17	14
Bulls	..	..	2	3	4	2	4
Horses	..	..	4	4	4	4	3
Totals	..	..	31	55	65	81	91

The fact that 90 acres of irrigated country, using a supply of 33 in. of water per acre, can carry ninety-one head of more or less well-grown stock must be regarded as being an excellent example of the carrying-capacity of the better class of country in Central Otago. In this connection it is of further interest to record that no fertilizers had been applied to the pastures prior to the end of the 1927-28 season.

One of the major problems relating to irrigated pastures, as evinced at Galloway, is the predominance of clover and the tremendous flush of growth during the peak growing months of December and January. The tendency of all paddocks to bolt at this period has been most marked, and in past years it has been found impossible to control this state of affairs, with the result that the best use was not being made of the pastures. During the present season the larger paddocks have been subdivided into smaller areas of approximately 4 acres each. These are now being rotationally grazed, the whole herd of fifty-six animals being pastured on one paddock at a time, and after two or three days in that paddock moved to another one. Thus the bloom is first taken off the paddocks by the milking-cows, which are then followed by dry stock, these grazing the grass closely and cleaning up surplus feed. When the dry stock are removed the paddock is harrowed and then irrigated. In fourteen days' time or thereabouts the paddock is again ready to be grazed by the milking-stock. This method of rotational grazing is ideally adapted to irrigation, and, apart from the extra cost entailed in fencing, must ultimately play an important part in the successful management of an irrigated dairy-farm.

The comparatively short grass-growing season in Central Otago is responsible for lower herd averages than obtain in more favoured dairy-ing districts. The Galloway herd, which, as already indicated, can be regarded only as an average farmer's herd, has been tested regularly, and it is interesting to note that the yield of butterfat for the season 1927-28 was 115 lb. per acre over the 90 acres of irrigated land. The season of 1928-29, not yet completed, will in all probability reach an average of not less than 137 lb. per acre. Calculating the over-all price of butterfat for the present season at 1s. 4d. per pound, this would return in gross receipts from butterfat alone the sum of £9 2s. 6d. per acre, which must be looked upon as quite satisfactory. Naturally this figure would be considerably increased if the cows were returning a higher average of butterfat per head, and unquestionably with selection and culling this could be accomplished very materially. The labour

entailed with a dairy herd of this size is quite considerable on an irrigated farm. At Galloway the services of a working manager and a full-time employee are necessary to cope with the milking of the herd and also to attend to the irrigation, while at harvest-time extra labour has to be employed. The total labour cost, therefore, on a 90-acre irrigated farm carrying fifty-six milking-cows is high.

For a dairy-farmer not employing labour outside the family probably 50 acres of irrigated country carrying twenty-five cows would be the maximum which could be reasonably handled, if the irrigation and harvesting of lucerne had to be attended to. In this respect the earning-capacity of a Central Otago dairy-farmer using irrigation is appreciably less than that of one in the more humid districts. Moreover, in the former case, chiefly for reasons of climate, the butterfat average per cow will usually be lower than in the latter.

There is no question that the income derived from dairy-farming can be considerably augmented by pig-raising, and with lucerne, skim-milk, and a dry climate pigs should thrive admirably and prove a valuable asset on an irrigated dairy-farm. During the season of 1927-28 fifty-six pigs were raised at Galloway, the gross receipts from these being £153. The utilization of skim-milk for this purpose is so far not being practised on the irrigated dairy-farms to the extent which it should be.

Concluding these notes, it may be claimed that, although no fortunes are to be made on the smaller irrigated farms of Central Otago, when the land is properly utilized and where sufficient water is obtainable to ensure adequate growth of crops comfortable homes can be established and satisfactory livings made.

SKIN ULCERATION IN PIGS.

A FORM of skin ulceration in pigs has recently come under notice of the Live-stock Division. The causative factor is found to be *Spirochaete suilla*, a soil organism associated with dirty yards and sties. The lesions set up are in certain respects similar to those caused by *Bacillus necrosis*, also a soil organism and met with in unsanitary yards and sties. The most common regions affected by the former organism are the head and ears, but later the trouble may spread to the shoulders and back.

Where this skin trouble has made its appearance it is advisable to segregate the affected animals. A thorough clean-up of the sties and disinfection of the entire premises is necessary. It may even be necessary in a badly infected site to transfer the piggery, or to build a new piggery on an entirely clean site. In the early stages scraping the skin slightly and the application of tincture of iodine or other antiseptic will assist in recovery of the affected animals.

That such troubles keep cropping up is only another illustration of the necessity of cleanliness and sanitation in connection with the feeding-troughs and utensils and the sties, and general attention to hygiene and care of the pigs. The old belief that pigs could live under almost any conditions is well recognized by the modern pig-keeper to be a fallacy, and conducive to diseases of many kinds and also to parasitic infestation.

—Live-stock Division.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1928.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE total number of cows admitted to the first-class Certificate-of-Record classes during the calendar year 1928 was 465, which represents a decrease of sixty-four certificates from the preceding year. It is difficult to account for this continued falling-off in entries, more particularly when the testing of ordinary dairy herds continues to increase. It would seem a natural expectation that the trend of the two movements would more or less harmonize. Group and Association herd-testing provide information which should be used as a basis for herd-building, and herd-building is most quickly and effectively accomplished through the use of a registered purebred dairy sire with an approved butterfat-record pedigree. Such a pedigree is only possible to the most desirable extent when it is supported by particulars of certificates of record gained by the various females whose names appear in the pedigree.

More herd-testing would suggest an increased demand for C.O.R. sires, and it would appear likely that ere long there will be a shortage. The special-purpose dairy cow has come to stay, for the simple reason that she can produce food for human consumption cheaper than can any other animal. Further, an extensive investigation recently carried out has proved that the average purebred dairy cow will produce more butterfat and produce it more cheaply than will the average grade or crossbred dairy cow. This is even stronger evidence of the necessity for herd-building through the medium of a C.O.R. sire. One of the principal objects in introducing the Certificate-of-Record test was to provide dairy-farmers with sires which, because of their C.O.R. butterfat-record pedigrees, might be accepted almost as a guarantee of sound and rapid herd-building. It is recognized that the need for economy during recent years has been reflected in decreased C.O.R. entries—C.O.R. testing involving expenditure in the fees, and more particularly in the extra feed and handling called for. But we are of the opinion that those breeders who have carried on with the testing during the leaner years, and have kept their pedigrees complete with C.O.R. records by testing representatives of each generation as they came along, will one day reap the benefit.

A sire or dam with an extended pedigree complete with authenticated butterfat records is preferable to an animal whose ancestry is but sparsely supported by yield figures. Better animals must be bred on the foundation of proved production if satisfactory results are to be obtained. Heredity is the basis of all successful breeding practice. It should also be borne in mind that the mere fact of a bull being a registered purebred is not sufficient assurance of quality. It is creditable butterfat-production generation after generation which counts, and the C.O.R. test provides opportunity for acquiring the desired data in this respect.

The Official Herd-test, an adjunct of the C.O.R. system, is now in its second year, and that it is meeting with the approval of C.O.R.

breeders is evidenced by the fact that the current season's figures show a distinct increase over the first season's entries. There are at date of writing 1,666 cows on Official Herd-test, compared with 1,506 a year ago. The number of C.O.R. cows per C.O.R. breeder is slightly lower this year than last, the figures being 2.92 as against 3.1. Just how much of this decrease is due to the influence of the O.H.T. is doubtful. A review of the O.H.T. system in the 1928-29 season and a comparison with the preceding season will be published in the *Journal* at a later date.

Although last year's C.O.R. entries were somewhat disappointing, there is encouragement in the fact that for the month of January, 1929, some 665 cows were tested under the C.O.R. system, the number of breeders represented being 226, which is an increase of 40 breeders and 66 cows over the corresponding month of 1928.

From the point of view of average production of C.O.R. cows the position is satisfactory. A review of the past six years shows that while production can hardly be claimed to have advanced it has not fallen back. Combining all C.O.R. cows the average butterfat production year by year from 1923 to 1928, both inclusive, runs 468.45 lb., 470.99 lb., 467.92 lb., 463.87 lb., 469.56 lb., and 469.53 lb. respectively. This shows neither increase nor decrease, but a hovering round a point. The variation between one year and another is perhaps partly the result of climatic and general conditions, and partly because one year may be prodigal of outstanding producers and another year featureless in this respect. There is also reason for the assumption that our average purebred cow is reaching the limit of butterfat-production in conformity with her present stage of development, and that increased yield can only be expected to arrive slowly as the result of improvement in type, or methods of feeding and handling, or both.

FIRST-CLASS CERTIFICATES ISSUED.

The total number of cows which have received first-class certificates since the commencement of the C.O.R. system has now (to end of 1928) reached 6,187. In 1928 there were issued 410 ordinary first-class certificates and 55 certificates on repeat performance, making a total of 465 certificates for the year. The following table gives particulars of certificates issued during the past two years:—

Table 1.

Breed.	1928.			1927.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	328	39	367	333	50	383
Friesian	66	13	79	65	24	89
Milking Shorthorn..	10	1	11	25	3	28
Ayrshire	3	2	5	16	1	17
Red Poll	2	..	2	10	2	12
Guernsey	1	..	1	..	..	..
Totals	410	55	465*	449	80	529†

* Representing 464 cows, one cow having qualified for two certificates within the year.

† Representing 528 cows, one cow having qualified for two certificates within the year.

SECOND-CLASS CERTIFICATES.

The number of second-class certificates issued during the year was once more but a small percentage of the total certificates gained, which signifies that testing breeders are doing all possible to have their cows calve within the fifteen-months limit required by the rules governing first-class certificate-of-record. The rules, of course, permit an extra thirty days—that is to say, sixteen months (485 days)—as the limit for the second class. Only twenty-two second-class certificates were issued in 1928. These included sixteen Jersey records with an average of 485.52 lb. butterfat, eight Friesians averaging 674.06 lb., one Red Poll with 305.51 lb., and one Ayrshire which yielded 638.80 lb. butterfat.

The average period between calving for test and calving subsequent to test for all cows which gained first-class certificates during the year under review was 390 days, being three days less than for the preceding year. The average period for the second-class certificate cows was 462 days, as compared with 468 days for 1927.

It is repeatedly noticed that there are some outstanding performances among the second-class certificate cows. In the year under review there was a Jersey junior two-year-old with 626 lb. butterfat, and a mature Jersey with 810 lb. There was a mature Friesian (Messrs. North and Sons' Rosevale Queen Sylvia Triumph) with 1,055 lb. butterfat; and two other mature Friesians are credited with 769 lb. and 785 lb. respectively. There was, too, an Ayrshire with 638.80 lb. butterfat. Although no doubt there are exceptions, the question arises whether there is not a tendency to hold some cows back from the bull too long, with the result that they fail to get in calf to the first or second service and thus calve too late for first-class C.O.R. In carrying the calf a shorter period of the 365 days test, the cow, of course, has more opportunity to produce to her maximum; but nature resents interference, and it is often worth while to sacrifice a few pounds of butterfat in order to assure a first-class certificate. It would appear, however, that the majority of our breeders are fully aware of this. The trouble of temporary sterility, which is fairly prevalent in the dairying districts, may also have had a part in some cases of late calving.

JERSEYS.*Class-leaders.*

Although many good Jersey performances were recorded during the year, the list of class-leaders remains as at the end of 1927. Among the outstanding Jerseys of 1928 may be specially mentioned Mr. John Murray's (Woodville) Te Ngutu Memory, a junior two-year-old, which produced 647.28 lb. butterfat; Mrs. M. A. Jennings's (Mauriceville) Lisbury Zenith's Sultana, a senior two-year-old, with 734.87 lb. butterfat; Mr. J. J. Goodwin's (Morrinsville) Rexcourt Lady Magnet, a three-year-old, with 880.19 lb.; and Mr. J. G. Robertson's (Eltham) Craigalea Bonnie, a four-year-old, with 728.58 lb. The other classes, although containing a number of good performances, did not include any records which seriously challenged the existing class-leaders. The list is repeated in Table 2.

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk	Butter-fat
<i>Junior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Ivondale Oxford Lass	R. S. Tuck, Waharoa..	1 338	240.5	365	12,107.7	731.29
<i>Senior Two-year-old.</i>						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271.6	365	12,962.2	768.46
<i>Three-year-old.</i>						
Ivondale Golden Lass	P. J. Petersen, Waitara	3 312	308.2	365	14,434.8	905.01
<i>Four-year-old.</i>						
Keston Flower ..	G. E. Yelchich, Wainuku	4 64	319.9	365	14,679.2	814.95
<i>Mature.</i>						
Holly Oak's Annie..	W. T. Williams, Pukehou (deceased)	5 9	350.0	365	18,522.7	1,056.49



TE NGUTU MEMORY (J. MURRAY, WOODVILLE).

C.O.R. in Jersey junior two-year-old class: 11,852.1 lb. milk, 647.28 lb. butterfat. Highest record for the class in 1928.

Jersey Class-averages.

The average C.O.R. Jersey for 1928 produced 456.92 lb. butterfat, as compared with 469.36 lb. for 1927, a decrease of 12.44 lb. It is noticeable, however, that there is a tendency for the junior two-year-olds to become an ever-increasing proportion of the entries for this breed. This fact must necessarily be reflected in the breed average. Some 367 cows were represented in 1928, as compared with 383 for 1927. Despite this decrease in the total cows it will be noticed that the

junior two-year-old class increased by seven cows, whereas the mature class dropped by thirteen. The only class of the five into which the breed is subdivided that showed an increase was the senior two-year-old. Although the membership of this class dropped by ten cows, the average production went up about $1\frac{1}{2}$ lb. of butterfat. The average lactation period for Jerseys in 1928 was 346 days—three days less than for the preceding year.

The class-averages for 1928 and 1927 are given in the following table:—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
		1928.	lb.	lb.
Junior two-year-old ..	174	350	7,385.8	415.60
Senior two-year-old ..	33	349	8,046.0	455.06
Three-year-old ..	58	339	8,585.5	481.87
Four-year-old ..	37	348	9,108.6	498.11
Mature ..	65	339	9,396.4	522.78
		1927.		
Junior two-year-old ..	167	348	7,280.2	416.07
Senior two-year-old ..	43	348	7,950.9	453.54
Three-year-old ..	56	348	8,962.3	498.69
Four-year-old ..	39	354	9,394.0	520.35
Mature ..	78	353	9,669.9	545.63

Despite the fact that the average C.O.R. Jersey for 1928 yielded less than the average Jersey for 1927, the average of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 is higher at the end of 1928 than at the end of 1927. This, of course, is accounted for by the fact that the average for the twelve months under review is higher than the average from the commencement to the end of 1927.

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in the following table:—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	1,911	345	6,992.3	391.15
Senior two-year-old ..	520	344	7,715.8	434.11
Three-year-old ..	750	342	8,369.8	465.78
Four-year-old ..	464	345	8,844.2	490.47
Mature ..	1,195	345	9,308.3	510.50
All ..	4,840	345	8,032.9	446.32

Jersey C.O.R. Bulls.

By a C.O.R. bull is meant a bull which has sired four certificate-of-record daughters, each daughter being from a different dam. In the appended list certain names are marked †, signifying that these are the names of champion butterfat bulls. This is a special class recognized by the New Zealand Jersey Cattle Breeders' Association. A champion butterfat bull is one which has at least five daughters from different dams, and in addition each daughter must double its minimum butterfat requirements for certificate. Some 292 Jersey bulls have now qualified for the C.O.R. list. The list which follows includes those Jersey C.O.R. bulls which have added to their number of C.O.R. daughters during the year, or have during that period newly qualified for the class; space precludes printing the complete list of C.O.R. bulls. Seventy-six bulls are eligible for inclusion here, while up to the present fourteen bulls have qualified for the champion class, eight of these appearing in the list.

Table 5.

Key to numbers opposite names: First number—first-class C.O.R. daughters, second number—ditto, qualified on subsequent performances, third number—second-class C.O.R. daughters, fourth number—total of preceding numbers. Bulls marked * qualified for C.O.R. list in 1928.

Grannie's Knight† ..	56	15	4	75	Eileen's Fox 2nd ..	6	0	1	7
Eminent's Fontaine ..	38	5	1	44	Fernaig Exile ..	6	0	0	6
Viola's Golden Laddie† ..	28	0	1	35	Marshal Aldan ..	6	0	0	6
V C † ..	22	3	0	25	Roto ..	5	2	0	7
Waipiko Masterpiece† ..	20	0	1	27	Maid's Egyptian General ..	5	1	1	7
Hawkesbury Emperor† ..	18	6	0	24	Matchless Raleigh ..	5	1	0	6
Meadowvale Conqueror ..	18	3	1	22	Ironmaster of Meadow-				
Soumise Tom† ..	18	2	2	22	brook ..	5	0	1	6
Belvedere Bilberry's Last ..	18	1	0	19	Anzac ..	5	0	0	5
Bilberry's Goddington ..	16	3	0	19	Beachlands Lively* ..	5	0	0	5
Sweet Fox of Collingwood ..	15	2	0	17	Dominion Golden Cygnet ..	5	0	0	5
Owl'er of Puketapu† ..	15	0	4	19	Grafton Pepper's Boy ..	5	0	0	5
Brampton Merry Boy ..	15	0	0	15	Rower's Beautiful Prince* ..	5	0	0	5
Maid's General ..	14	2	1	17	Waipiko Lionello ..	5	0	0	5
Meadowvale General ..					Reid Park's Teasle ..	4	1	1	6
Daisy ..	13	1	2	16	Golden Victor ..	4	1	0	5
Fox's Double ..	13	0	0	13	Jersey Brae Majesty* ..	4	1	0	5
Woodstock Golden Lad ..	11	2	1	14	King Molma* ..	4	1	0	5
Distinction's Twylish ..	11	0	1	12	Meadowvale Gambollor* ..	4	1	0	5
Ngahiri Silent Knight† ..	11	0	0	11	Oakvales M. C.* ..	4	1	0	5
Beachland's White Swan ..	10	3	0	13	Orange Dale Draconis ..	4	1	0	5
Bright Sultan ..	10	0	0	10	Dominion Conqueror* ..	4	0	1	5
Marshlands Masterpiece ..	10	0	0	10	Pinewoods Golden O K.* ..	4	0	1	5
Achievement of Willow-					Antrim* ..	4	0	0	4
bank ..	9	2	1	12	Beachlands Little Swan* ..	4	0	0	4
Sherry's Fox of Colling-					Cute's Rozel Lad* ..	4	0	0	4
wood ..	9	2	1	12	Fern's Golden King* ..	4	0	0	4
Silver Conqueror ..	8	2	0	10	Flandrine's Golden Lad* ..	4	0	0	4
Exile of Cloverland ..	8	0	2	10	Holly Bank Hero* ..	4	0	0	4
Clanon ..	8	0	1	9	Holly Oak Gander* ..	4	0	0	4
Molly's Lad ..	8	0	1	9	Ku Ku Corporal* ..	4	0	0	4
Noble Warder ..	8	0	0	8	Ku Ku Scotty* ..	4	0	0	4
Lord Nelson ..	7	3	1	11	Leighurst General* ..	4	0	0	4
Golden Swan's Lad ..	7	3	0	10	Maori French* ..	4	0	0	4
Majesty's Squire ..	7	2	0	9	Maori Monarch* ..	4	0	0	4
Willowbrook Lord ..	7	1	0	8	Mercedes Golden Laddie* ..	4	0	0	4
Centurian ..	7	0	0	7	Nominees Golden Laddie* ..	4	0	0	4
Hawkesbury Majestic ..	7	0	0	7	Rosemont Pilot* ..	4	0	0	4
Blondin ..	6	8	0	14	Sunbeam's Sultan* ..	4	0	0	4
Xenia's Oxford Lad* ..	6	1	0	7	Waipiko Journalist* ..	4	0	0	4

FRIESIANS.

Class-leaders.

After remaining for almost five years without alteration, a change came to the Friesian class-leadership list in 1928. This change, which was referred to in detail in the *Journal* for November, 1928, occurred in the senior two-year-old class. Pareora Echo Blossom, bred by Mr. A. S. Elworthy, of Holme Station, Timaru, and tested by Mr. T. Sheriff, Clandeboye, gained a certificate for 819·81 lb. butterfat, thus displacing Mr. John Donald's Netherland Princess 4th, who had been the leader since the 1913-14 season, the second year of certificate-of-record testing in New Zealand. The margin between the two records was 14·04 lb. butterfat. The list of Friesian class-leaders is now as follows:—

Table 6.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate	Yield for Season.		
				Days.	Milk.	Butterfat.
<i>Junior Two-year-old.</i> Monavale Queen Bess	T. H. Richards, Cardiff	<i>Yrs. dys</i> 2 16	<i>lb.</i> 242·1	365	<i>lb.</i> 20,501·1	<i>lb.</i> 740·50
<i>Senior Two-year-old.</i> Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
<i>Junior Three-year-old.</i> Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
<i>Senior Three-year-old.</i> Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmers- ton North	3 296	306·6	365	18,733·9	863·51
<i>Junior Four-year-old.</i> Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
<i>Senior Four-year-old.</i> Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
<i>Mature.</i> Alcartra Clothilde Pietje	Vernon Marx, Manga- toki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class-averages.

Seven C.O.R. Friesian classes are recognized, and in 1928 four of these showed increased average production when compared with 1927. The average C.O.R. Friesian for the year is credited with 527·97 lb. butterfat, a substantial increase over the preceding year's figure of 502·09. Several of the classes are but sparsely represented, and consequently the average yield within such classes is too largely influenced by individual performances to be representative from a

comparison point of view. The mature class, however, is a particularly strong one, the average for the eighteen cows being no less than 651.74 lb. butterfat. As with the Jerseys, the junior two-year-old and the mature are the strongest classes numerically. A total of seventy-nine Friesians were certificated in 1928, as compared with eighty-nine in 1927. The average lactation period for all Friesians in 1928 was 352 days, five days less than for the preceding calendar year. The class-averages for the Friesian breed for the past two years are as follows :—

Table 7.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
1928.				
			lb.	lb.
Junior two-year-old ..	27	339	12,586.7	430.79
Senior two-year-old ..	13	351	13,668.6	490.17
Junior three-year-old ..	5	320	12,345.1	449.25
Senior three-year-old ..	8	362	16,300.8	602.37
Junior four-year-old ..	4	365	17,406.8	604.63
Senior four-year-old ..	4	361	17,122.1	622.87
Mature	18	352	18,867.1	651.74
1927.				
Junior two-year-old ..	32	346	12,250.0	432.18
Senior two-year-old ..	13	336	12,615.3	455.66
Junior three-year-old ..	7	345	14,681.3	502.82
Senior three-year-old ..	3	161	7,853.8	315.89
Junior four-year-old ..	4	359	17,275.4	610.31
Senior four-year-old ..	5	331	13,968.6	489.10
Mature	25	341	17,449.6	623.13

Tabulation of the averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system in 1912 evidences an increase in the production of the average certificated Friesian to the end of 1928, the present figure being 476.18 lb. butterfat, as compared with 473.58 to the end of the preceding year. The table is as follows :—

Table 8.

Class.	Number of Certificates	Average Yield for Season		
		Days in Milk	Milk	Butterfat.
			lb	lb
Junior two-year-old ..	475	344	11,377.9	402.92
Senior two-year-old ..	216	346	12,347.5	438.00
Junior three-year-old ..	158	340	13,120.0	461.30
Senior three-year-old ..	154	336	13,664.8	488.79
Junior four-year-old ..	100	343	14,820.8	522.31
Senior four-year-old ..	95	347	15,631.2	542.68
Mature	459	339	15,639.5	547.03
All	1,657	342	13,515.1	476.18

Friesian C.O.R. Bulls.

The Friesian C.O.R. bulls now total ninety-five, and three of these qualified for their place in the C.O.R. list during the past year. The number of bulls of this breed entitled to appear in the present summary—that is to say, bulls which have added to their number of C.O.R. daughters during the year, or have during that period newly qualified for the class—is fifteen.

A glance through our bull records for the Friesian and Jersey breeds reveals an interesting position. To the end of 1928 some 4,263 Jersey cows had received certificates. These cows were by no less than 1,550 different sires. In all 292 Jersey bulls have qualified for the C.O.R. class, and these have sired 54·5 per cent. of the Jersey cows



ROSEVALE GLADYS POSCH (NORTH AND SONS, OMIMI).

C.O.R. in Friesian mature class: 28,555·2 lb. milk, 940·43 lb. butterfat. Highest record for the class in 1928, and the year's highest first-class certificate for all breeds.

certificated to date. Some 782 bulls had only one C.O.R. daughter, 296 had two, 160 had three, while 20 had four C.O.R. daughters, but not from different dams as required for C.O.R. qualification.

For the Friesian breed ninety-five bulls are in the C.O.R. class, and these have sired 57·3 per cent. of the 1,349 Friesian cows certificated to date. Altogether 481 Friesian bulls are represented in our C.O.R. list; of these 256 have sired one C.O.R. cow each, seventy-eight have two C.O.R. daughters, forty-eight have three, while four have four daughters not from different dams.

These figures are interesting, and go to show that while in many cases a sire's worth has been proved through the productive ability of his daughters, and that many breeders are continuing to breed along proven lines, there is a large proportion of cases in which the sire has been allowed to remain a more or less unknown quantity.

The list of Friesian C.O.R. bulls is as follows:—

Table 9.

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1928.

Rosevale Korndyke Sylvia					Carnation King Matador				
Posch	18	14	3	35	Betty*	8	0	0	8
Rosevale King Sylvia ..	16	3	5	24	Rosevale Inka Sylvia				
Ensign Pontiac Valdessa					Model	7	1	0	8
Fayne	14	2	1	17	Rosevale Plus Triumph	6	6	1	13
Dominion Woodcrest					Pietje Johanna de Kol ..	6	0	0	6
Piebe Mercedes	13	3	1	17	King Segus of Friesland				
Echo Sylvia Sir Griselda	10	0	2	12	Park	5	2	1	8
Marquis Segus Colantha	9	3	1	13	Bainfield Netherland				
Woodcrest Pontiac Alcartra	9	3	1	13	King Pontiac*	5	0	0	5
					Parcora Cadillac Hero ..	4	3	0	7
					Rosevale Burke Posch*	4	0	0	4

MILKING SHORTHORNS.

Class-leaders.

There have been no changes during the year in the Milking Shorthorn class-leaderships, and with one exception no outstanding performances have been recorded. The exception is that of Dominion Conceit of Ruakura, a cow owned and tested at the Ruakura Farm of Instruction, Hamilton, which in the mature class made the very creditable record of 727·35 lb. butterfat. The list of class-leaders is here repeated:—

Table 10.

Name of Cow and Class.	Tested by		Age at Start of Test.	Fat required for Certificate.	Yield for Season		
					Days	Milk	Butter-fat.
<i>Junior Two-year-old.</i> Matangi Quality 4th	Ranstead	Bros., Ma-	Yrs dys 2 109	lb. 251·4	365	lb. 14,572·8	lb. 591·89
<i>Senior Two-year-old.</i> Matangi Quality 5th	Ranstead	Bros., Ma-	2 204	260·9	365	11,752·8	542·66
<i>Junior Three-year-old.</i> Matangi Quality 4th	Ranstead	Bros., Ma-	3 153	292·3	365	16,281·4	678·02
<i>Senior Three-year-old.</i> Matangi Ruth 2nd ..	Ranstead	Bros., Ma-	3 304	307·4	365	14,032·7	747·86
<i>Junior Four-year-old.</i> Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama		4 0	313·5	358	14,640·2	630·38
<i>Senior Four-year-old.</i> Matangi Ruth 2nd ..	Ranstead	Bros., Ma-	4 355	349·0	340	11,670·3	644·90
<i>Mature.</i> Glenthorpe Lady ..	A. J. Melville, Buckland		Mature	350·0	365	20,136·2	856·85



DOMINION CONCEIT (RUAKURA FARM OF INSTRUCTION, HAMILTON).

C.O.R. in Milking Shorthorn mature class: 16,255·1 lb. milk, 727·35 lb. butterfat. Highest record for the breed in 1928.

Milking Shorthorn Class-averages.

Only eleven first-class certificates were issued to Milking Shorthorns in 1928, compared with twenty-eight for the preceding year. The average production for the eleven cows was 480·96, the previous year's figure being 445·82. In the year under review only four of the seven classes were represented, so that obviously a table of averages would be almost valueless from a comparison point of view, and consequently it is omitted this year. The eleven cows were made up of one junior three-year-old, which gave 334·46 lb. butterfat; three senior three-year-olds, which averaged 411·07 lb.; one senior four-year-old, with 409·66 lb.; and six mature cows, which gave the very creditable average of 552·21 lb. butterfat.

The following table shows the average, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914:—

Table 11.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	47	351	8,446·4	346·06*
Senior two-year-old ..	24	347	8,511·8	347·17*
Junior three-year-old ..	20	335	9,507·2	378·93
Senior three-year-old ..	22	342	10,626·2	451·49
Junior four-year-old ..	18	349	10,883·2	440·58*
Senior four-year-old ..	24	343	11,859·5	466·83
Mature	227	340	11,624·0	464·23
All	382	342	10,849·1	436·19

* No additional cows for 1928

Milking Shorthorn C.O.R. Bulls.

Eight Milking Shorthorn bulls have now qualified for the C.O.R. class, and of these three are eligible for inclusion in the present summary. One C.O.R. bull added to his number of daughters, while two new names were added during the year. Particulars for the three bulls are as follows: Dominion Glaxo of Ruakura, 7-0-0-7; Acorn of Oakdale, 4-1-0-5; Dominion Banker of Darbalara, 4-0-0-4—the two last mentioned being the newly qualified bulls. (See key to numbers at head of Jersey bull list.)

AYRSHIRES.*Class-leaders.*

One outstanding Ayrshire record was made during the year, and this brought a change of class-leadership. The cow referred to is Floss of Braeside, tested by Mr. W. Moore, of Homebush, Masterton. Her yield of 832.72 lb. butterfat increases the leadership of the mature Ayrshires—previously held by Mr. A. Montgomerie's Glencairn Brownie—by no less than 104 lb. The class-leaders for the breed are now as follows:—

Table 12.

Name of Cow and Class	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.			
				Days.	Milk.	Butter- fat.	
<i>Two-year-old</i>		<i>Yrs.</i>	<i>dys.</i>	<i>lb.</i>	<i>lb.</i>	<i>lb.</i>	
Fair Maid of Green bank	W. Moore, Homebush	2	27	243.2	365	12,281.3	673.56
<i>Three-year-old.</i>							
Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3	312	308.2	365	12,334.2	574.09
<i>Four-year-old.</i>							
Ivanhoe Fancy	A. M. Weir, Menzies Ferry	4	308	344.3	365	14,207.7	713.93
<i>Mature.</i>							
Floss of Braeside	W. Moore, Homebush	7	287	350.0	365	20,305.5	832.72

Ayrshire Class-averages.

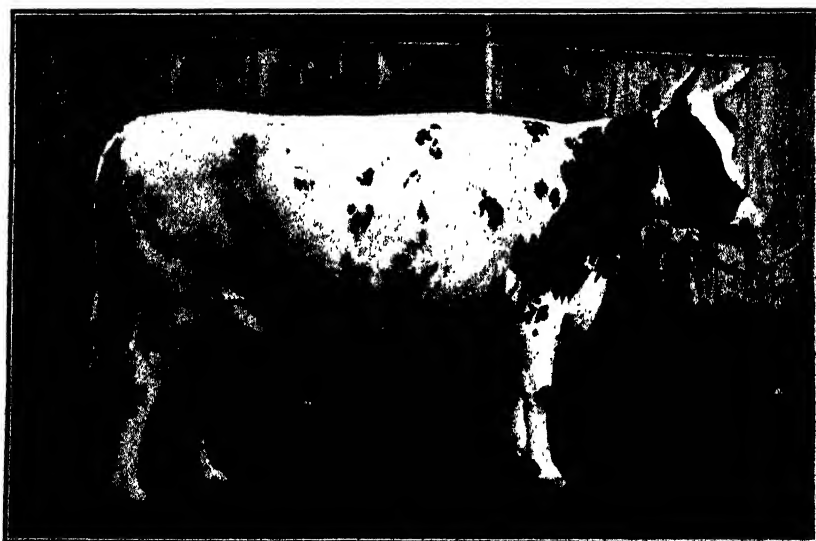
Only five Ayrshire cows received first-class certificates during 1928, and only two of the four classes into which this breed is usually subdivided were represented, consequently satisfactory comparisons with previous years cannot be drawn. One of the cows fell in the two-year-old class and gave 323.22 lb. butterfat. The other four, which were in the mature class, averaged 569.22 lb.; while all five averaged 520.02 lb.

The averages, class by class, of all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are shown in Table 13 (next page).

Table 13.

Class.				Average Yield for Season.		
				Days in Milk.	Milk.	Butterfat.
					lb.	lb.
Two-year-old	..	..	51	342	8,702.2	357.96
Three-year-old	..	..	30	345	9,817.3	402.29*
Four-year-old	..	..	23	347	11,263.3	455.57*
Mature	..	..	94	347	11,930.4	487.58
All	..	..	198	346	10,701.2	437.55

* No additional cows for 1928.



FLOSS OF BRAESIDE (W. MOORE, HOMEBUSH).

C.O.R. in Ayrshire mature class: 20,305.5 lb. milk, 832.72 lb. butterfat. New leader of her class.

Ayrshire C.O.R. Bulls.

No additions to the list of qualified Ayrshire C.O.R. bulls were made during the year. Seven bulls have qualified for the C.O.R. class to date.

RED POLLS.

The class-leaders for the Red' Poll breed remain as at the end of 1927, and are reprinted in Table 14 (opposite page).

Only two Red Polls were certificated last year. These were owned and tested by the Central Development Farm, at Weraroa, and both were in the two-year-old class. Their average production was 275.68 lb. butterfat.

Table 14.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days	Milk.	Butterfat.
<i>Two-year-old.</i> Wayward 6th B No. 1	G. S. Young, West Plains	Yrs dys. 2 188	lb. 259.3	365	11,228.0	511.42
<i>Three-year-old.</i> Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307.2	365	9,491.25	459.46
<i>Four-year-old.</i> Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343.2	365	13,290.0	580.05
<i>Mature.</i> Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350.0	365	11,009.00	505.84

The following table shows the averages, class by class, of all certificates issued to Red Poll cows since the commencement of the C.O.R. testing for this breed in 1918:—

Table 15.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
Two-year-old	35	342	7,543.5	333.96
Three-year-old	12	345	7,930.9	346.08
Four-year-old	6	343	9,909.1	425.86
Mature	18	331	9,972.3	421.32
All	71	340	8,424.7	365.92

Red Poll C.O.R. Bulls.

The Red Poll bull list remains unaltered. Three bulls have qualified, their names being Aviator, Belligerent, and Force Majeure.

GUERNSEYS.

The first Guernsey certificate under the New Zealand C.O.R. system was issued during the year under review. This went to Dominion Du Preel, who, commencing test at the age of 3 years 332 days, produced 487.46 lb. butterfat from 9,260.3 lb. milk in 365 days. As the prefix "Dominion" signifies, this cow is owned by the New Zealand Government, and she was tested at the Ruakura Farm of Instruction, Hamilton.

Considering the undoubted merits of the breed, it has always been somewhat surprising to us that the Guernsey has not been more strongly represented numerically in New Zealand. No doubt the principal difficulty lies in the matter of finance. Importation is expensive, and the problem of finding fresh blood is ever present.

Every few years new sires are required to counteract inbreeding, and as there are only some four (or perhaps half a dozen) Guernsey breeders in New Zealand, and these with small herds, importation becomes imperative if the breeding is to be continued successfully.

The Guernsey has established a favourable reputation in England, the United States, Canada, and even Australia. Climatically most parts of New Zealand should be ideal for Guernseys, and they are particularly fine butter-cows. In a general way the Guernsey is approximate to the Jersey in appearance, but is larger, somewhat rougher, and of more broken colour. The Guernsey is, of course, one of the Channel Island breeds, and it is held by some historians that she came from the same original stock as the Jersey, but was founded on the larger and more robust individuals. The fat in Guernsey milk has a pronounced yellow tint, and this fact originated the title of the "golden-butter breed" which has been bestowed upon it by the admirers of breed.

In her native home the Guernsey has many authenticated records around the 800 lb. to 900 lb. of butterfat mark, and in America more than half a dozen Guernsey cows have been credited with productions of over 1,000 lb. The merits of the breed will thus be apparent, and we are of opinion that the Guernsey could be introduced with advantage to many of our established dairying districts.

Once again the Dairy Division desires to extend its thanks for the help afforded by the secretaries of those breeders' associations co-operating in connection with the certificate-of-record testing. The C.O.R. work is now so firmly established that each year brings fewer calls for alteration of our system, and consequently fewer occasions on which it is necessary to enlist the assistance of the several association secretaries. Nevertheless, correspondence concerning entries, returns, &c., is frequently passing between us, and we have always found them untiring in their efforts to lighten our labours. In this connection we would record the names of Mr. W. M. Tapp (Jersey Cattle Breeders' Association); Mr. J. P. Kalaugher (Friesian Association); Mr. A. W. Green (Milking Shorthorn Association); Mr. R. H. Spencer (Ayrshire Cattle Breeders' Association); and Mr. L. J. Wild (Red Poll Cattle Breeders' Association).

LAWN-MOWER METHOD FOR MEASURING GRASS-YIELD.

THE technique of frequent mowings as a measure of production is being tried at the Marton Experimental Area this season. The effect of applying two different kinds of phosphate at four different periods of the year is being tested. Cuttings are made at about fourteen days' interval. No attempt has been made to carry out cuttings at regular intervals, but it happens that a convenient growth for cutting (or grazing) occurs in about fourteen days. Hence it will be seen that a good measure of seasonal production is also obtained. Results up to the present indicate: (1) That there is no particular flush of growth about November, as is commonly supposed, but that production on a well-managed pasture is fairly uniform throughout the growing-season, providing rainfall is adequate and temperature suitable; (2) that superphosphate at 3 cwt. per acre on the land in question gives its maximum effect about six to eight weeks after application, when rainfall has been sufficient for plant requirements.

CONTROL OF RAGWORT WITH SHEEP.

Live-stock Division.

RAGWORT, which now infests large areas and is still spreading more or less throughout the Dominion, is a perennial plant and a free seeder, and on lands where it is allowed to flower and seed the ground becomes polluted. As the seed can lie dormant in the soil for some time, and will germinate when favourable conditions arise, some few years must necessarily elapse before the complete eradication of the weed on any given area can be claimed with any certainty. In addition to its propagation by means of the seed, the plant, which dies down in winter, each spring makes new and vigorous growth from its roots for some years before dying out. On tillable land control is a fairly simple matter, but there are large areas of infested bush grasslands only partially cleared of logs and stumps, which, at present at least, are unfit for tillage except at heavy preparation cost. Under such conditions other means of control must be resorted to by the progressive landholder.

Control of ragwort by means of sheep has for many years been carried out by settlers in both the North and South Islands with equal success, though under very different climatic conditions as between the far North and the far South. This method of attack has on many farms been an unqualified success, with practically no abnormal mortality among the stock, while mismanaged efforts on the part of neighbouring settlers have resulted in failure with heavy stock losses. All this goes to show that the human element plays a most important part in the control of ragwort, even when the simple means of eradication is grazing with sheep. By means of sheep, with proper handling, a fair measure of control of the weed can be attained in from two to three years.

When stocking lands badly infested with ragwort it has always to be borne in mind that the plant has often a most injurious and poisonous effect upon horses and cattle, but to a very much lesser degree upon sheep. Where it is possible to heavily stock the land with sheep during the late winter and early spring months, when pastures are more or less depleted and the ragwort growth is young and succulent, very good results are obtained. The plants are never allowed to seed, and in course of a few years a complete elimination of the weed is the result. For satisfactory control with sheep small paddocks are desirable where possible, in order to enable the changing of the sheep from field to field, thus obviating the fouling of the pastures. Experience has proved that aged ewes are the best class of sheep to employ for clearing ragwort country, these being less effected by the toxic principle of the plant than younger sheep. Again, these old sheep are found to eat the soft crown out of the ragwort in spring, which is fatal to the plant. Younger sheep are more apt to leave the crown alone and pay more attention to the outer leaves, which means a slower measure of control.

A method sometimes employed is to leave the weed until it is in full flower and then turn a large mob of sheep on it, in order that they may devour the flowers and upper leaves of the plant and thus prevent

its seeding. This plan, however, is not generally advocated, as if the sheep are left on the ragwort too long while it is in this very rank and more dangerous stage the mortality is sometimes heavy, and many of the carcasses are found on slaughter to be very yellow in colour. This method can be advised only in cases where the sheep can be moved on to clean pasture after a few days on the flowering weed. In any case it cannot compare with the before-mentioned plan of stocking up in the late winter and early spring. Sheep possess a fair immunity to the poisonous elements of well-cropped ragwort, and can be kept on infested country for a more or less lengthy period without ill effects, provided the weed is kept well grazed down and is not allowed to grow rank or to flower. On some lands where the ragwort had obtained complete control, with consequent smothering out of all other pasture, the feed consists of ragwort and little else. It is unwise to keep any class of sheep, whether old ewes or not, on such feed for more than one season, otherwise in the second and subsequent years a heavy loss from cirrhotic liver trouble may result. Such sheep when rounded up soon show that all is not well with them. In order to minimize the possibilities of trouble, sheep grazing on infested land should be enabled to obtain a fair quantity of good herbage in addition to the ragwort.

Control of ragwort on purely dairying-country presents more difficulties in the matter of control than is the case where the land can be given over more or less entirely to sheep. On many comparatively small dairy-farms very good results in respect to ragwort control have been obtained by grazing a few aged ewes with the dairy cows during the late winter and spring and early summer months. After the first month or so there is ample feed for both the cows and sheep, and the old ewes keep down the ragwort, so that little if any is allowed to flower and seed. Then, when the season is well advanced and before the pasture begins to wane, the sheep, with lambs at foot, are sold off, in most cases at a profit. Small paddocks are of distinct advantage in the control of the weed on these dairy-farms also.

Top-dressing of infested patches of ragwort with fertilizers is also a great help in the control of ragwort and other weeds, owing to the stimulation of the grass pasture and making it more palatable to the stock, thus promoting the trampling down and crushing out of the weed.

Reports have been obtained recently from Stock Inspectors, some of which state in no uncertain terms that on many farms ragwort is now under complete control. Dairy-farmers on badly infested lands have, with the assistance of ewes, subdivision of the larger fields into smaller ones, and regular moving of stock from field to field, improved their farms in carrying-capacity and appearance out of knowledge, with little or no loss of stock from ragwort poisoning. Instances given are as follows:—

“A.”—Area of farm 280 acres, easy hills, fair amount of flat. When first occupied fifteen years ago ragwort was distributed over the whole area. For first seven years grazed sheep only, then added dairying to his other activities and has since carried sixteen to twenty-two cows besides a flock of ewes. At present is milking on the area twenty cows and grazing four hundred ewes. Country thoroughly

clean, and owner quite satisfied that ragwort can be easily controlled by good fencing, small paddocks, and judicious stocking. Has had no deaths attributable to ragwort.

"B."—Area 200 acres, easy hills, fair amount of flat. Three years ago was covered with heavy ragwort. Farm was given over to sheep-grazing and is still carrying sheep only. No sign of ragwort for some time past, and country has appearance of excellent condition. No mortality among sheep reported.

"C."—Area 110 acres, about a quarter of area under ragwort. Some years ago lost eleven head of cattle and two horses from ragwort poisoning. Was advised to place sheep on ragwort area, and procured seventy old ewes in March, 1927. Ewes kept on country practically ever since, and no sign of ragwort noticeable. No further deaths from ragwort. States ragwort now gives no trouble, and only wishes he had known value of sheep control earlier. Throughout whole period has also milked from twenty-five to thirty cows.

"D."—Area 120 acres. First occupied fifteen years ago when land was practically free from ragwort. Eight years ago found ragwort becoming plentiful, and purchased a number of sheep to control it. Now winters approximately one hundred and fifty sheep, mostly ewes, and thirty-three cattle, twenty-five of these being dairy cows. Farm is now practically free from ragwort. No deaths attributable to ragwort. Owner satisfied that the weed can be effectively controlled with ewes without loss to the farmer's profits.

"E."—Area approximately 120 acres. First occupied by present owner fifteen years ago. Ragwort then bad in patches. Has always carried a number of ewes to control the weed. Milks twenty-five cows and carries one hundred ewes. Native-owned property nearby, which for years carried no stock and which was infested with ragwort, is now stocked with sheep and now no ragwort visible. Is a firm believer in the control of ragwort on dairy lands by means of sheep.

Leading points for farmers to bear in mind are: (1) Division of farm into reasonably small paddocks, with good sheep-proof fences; (2) carrying of sheep—old ewes for preference—unless to be replaced each year; (3) moving of stock regularly from field to field; (4) top-dressing of infested patches where it can be done; (5) sheep to be put on dairy-farms in late winter for preference, if not intended to be kept throughout the whole year.

LINSEED-RUST CONTROL WORK.

In a recent report the Director of the Plant Research Station, Palmerston North, states: "The J.W.S. linseed now being grown in New Zealand by arrangement with the Empire Marketing Board (350 acres this season) was unfortunately contaminated with linseed rust when shipped here. It is highly necessary to secure clean lines of this seed for future sowings, and an attempt has been made to treat seed so that a clean crop could be secured. The treatment, however, has not been successful, and it will be necessary to fall back on the selection of individual healthy plants for the production of a nucleus line of healthy seed. In the case of this rust it is not definitely known whether the disease is actually carried in the seed or whether contamination of a line is due only to teleutospores being present amongst the seed. If the disease is mainly transported as teleutospores in seed-samples there should not be any great difficulty in hand selection for freedom from the disease."

MATURITY OF APPLES IN RELATION TO LONG STORAGE.

SOME TRIALS WITH THE IODINE TEST.

M. DAVEY, Horticulture Division, Wellington.

THE question of the best stage of maturity at which to pick fruit to ensure efficient long storage, and the elimination of waste during storage from physical defects and fungus rots, has exercised the minds of those engaged in the fruit industry for many years past. The results of practice, rather than definite tests, have led to the present generally accepted conclusions regarding the most desirable condition in which apples should be gathered, and this has led to a fair degree of success only.

Dealing with apples and pears, one finds that there still exists a wide divergence of opinion regarding the correct time at which these fruits should be harvested to ensure long storage, and it would appear that unless some other method than that of macroscopical examination is employed no finality is likely to be reached regarding a matter which is of primary importance when applied to pip-fruits, and possibly to other fruits rich in starch or sugars and intended for long storage or transport.

As long ago as 1905 it was shown by Bigelow, Gore, and Howard that the process of ripening, so far as the conversion of starch into sugar in apples was concerned, could be followed by the use of iodine solution; and as recently as 1927 Carne and Wickens carried out tests with iodine solutions in an endeavour to solve the problem or reduce the losses incidental to the development of bitter-pit in apples during storage.

Our Department of Agriculture, conscious of the fact that the occurrence of bitter-pit in some varieties of apples, particularly Cox's Orange, is possibly aggravated by picking in the early stages of maturity, decided to carry out tests this season on the lines indicated by previous investigations. Although the tests are only in the initial stages, it has been considered advisable to publish a brief progress report on the information at present available.

The recently taken photographs here reproduced indicate the process of starch conversion to sugar in the apple, which takes place quite rapidly, and which may ultimately decide that a very limited period indeed exists in which certain varieties of apples may be harvested to the best advantage. It is necessary to explain the effect derived by application of the iodine solution to the flesh of the apples, which have been cut in half equatorially. Immersion of the cut surface for the brief period of half a minute shows a starch reaction of an iron-grey to blackish-purple, according to the variety of apple and degree of immaturity, while those portions of the flesh in which starch conversion has taken place show little or no reaction, according to the completeness of the change.

The six Cox's Orange apples in Fig. 1, which were highly coloured, show practically no conversion of starch, with the exception of Nos. 5 and 6, which indicate a slightly matured condition round the core.

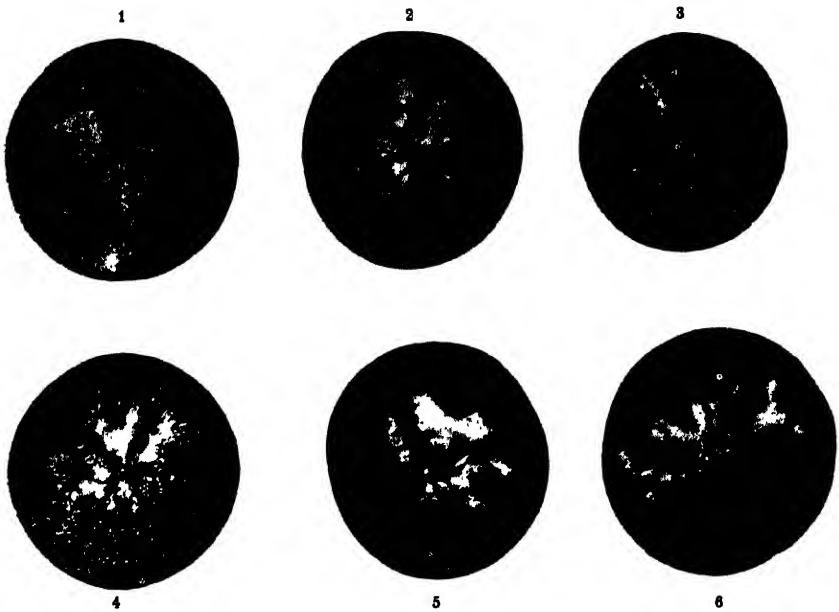


FIG. 1. SECTIONS OF HIGHLY COLOURED COX'S ORANGE APPLES AFTER IODINE TEST, SHOWING IMMATUREITY OF FLESH.

The speckled appearance on cut surface is due to free moisture. In this and the other photos the specimens are reduced from natural size.

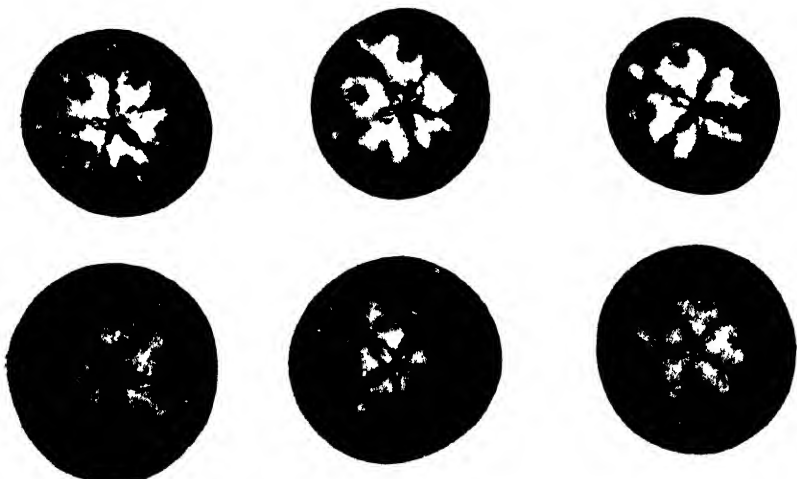


FIG. 2. APPLES FROM SAME TREES AS THOSE IN FIG. 1, PICKED EIGHT DAYS LATER, SHOWING CONVERSION OF STARCH TO SUGAR.

Top row 216, bottom row 175 pack size.

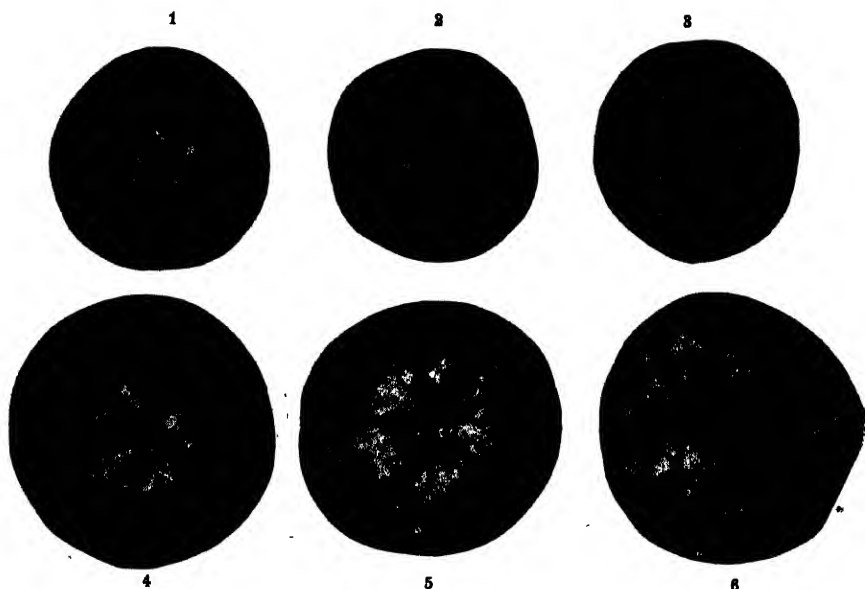


FIG. 3. HIGHLY COLOURED WORCESTER PEARMAIN APPLES, SHOWING WIDE DIFFERENCES OF MATURITY BY IODINE TEST.

Top row 198, bottom row 139 pack.

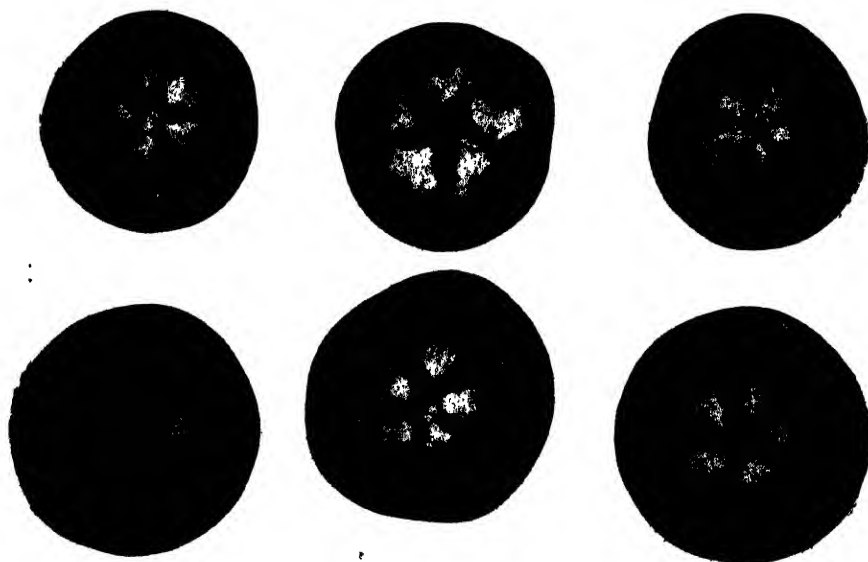


FIG. 4. POORLY COLOURED WORCESTER PEARMAINS, SHOWING UNIFORM MATURITY OF FLESH BY TEST.

Top row 198, bottom row 138 pack

In contrast to this condition, Fig. 2 shows a general and uniform condition of starch-conversion extending to the surface of the fruit, although this fruit was picked only eight days later and from the same trees as that shown in Fig. 1.

W. M. Carne, Plant Pathologist, Department of Agriculture, Western Australia, puts forward the theory that bitter-pit is due to the actual picking of the fruit in an immature condition. He considers that it is caused by a loss of water from the fruit as a whole, which is finally borne by the more immature cells, resulting in their drying-out and death. This effect on the immature cells is caused by the irregular manner in which apples ripen, the more mature or sugar-filled cells being in close association with less mature starch-filled cells. As the result of osmotic action, the sugar-filled cells draw water from the starch-filled cells. If the loss from the latter is sufficiently great they are killed.

If one accepts this line of reasoning it can be easily understood that the sudden severance of a supply of sap from tree to fruit, brought about by picking, would aggravate bitter-pit at a stage when the moisture-content of the cells is high, and would suggest that the safer procedure would be to delay picking until such time as the maturity had reached the stage shown in Fig. 2.

Coming to the Worcester Pearmain variety, Fig. 3 shows sections of highly coloured fruit with a greenish-yellow ground colour, while the apples in Fig. 4 were very poorly coloured fruit, the ground colour being light green. The highly coloured apples show wide differences of maturity under the iodine test, although the amount of colour on each apple was 90 per cent. The poorly coloured apples (only 10 per cent. colour) under test show uniform maturity, indicating that red colouring is only a superficial effect in indicating flesh maturity. Particular note should be taken of apple No. 1 in Fig. 3, which was a very highly coloured fruit even in its class, but which under test shows less maturity than any of the green apples in Fig. 4. An iodine test of a similar number of Worcester Pearmain apples, applied nine days previously, showed very slight starch-conversion, and this closely confined to the core, again indicating that harvesting might be delayed with advantage until the fruit reached the stage shown in the more matured specimens of Figs. 3 and 4.

Fig. 5 shows effects which are not so conclusive. The six Jonathan apples, picked at the same time from the same tree, the apples being of exactly similar appearance externally, indicate a wide range of maturity under the iodine test. Nos. 1 and 2 show a uniform starch-conversion extending to the surface of the fruit. Nos. 3, 4, and 5 show practically no starch-conversion, while No. 6 appears to show quite an advanced stage of maturity. The condition of this apple, which carried a grass-green ground colour, opens up the question of whether apples of the same variety contain a widely different starch content. This specimen seems to indicate that at least a small proportion of individual fruits do differ in this respect, and the type of fruit represented by it is consistent with this assumption, this particular apple being one of those soft, spongy fruits lacking flavour and sweetness even when maturity is fully developed and the entire starch content converted into sugar.

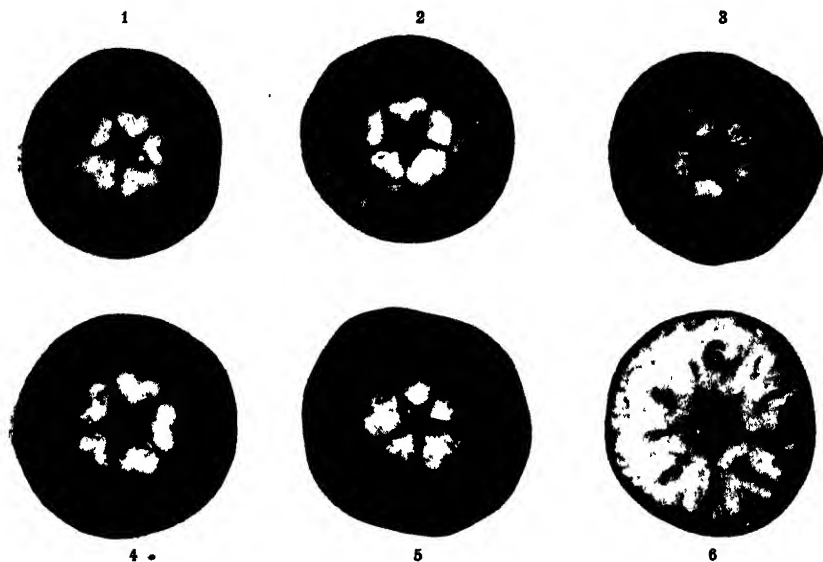


FIG. 5. JONATHAN APPLES, ALL OF SIMILAR EXTERNAL APPEARANCE (10 PER CENT. COLOUR) AND PICKED AT SAME TIME, SHOWING WIDE RANGE OF MATURITY BY IODINE TEST.

Top row 175, bottom row 150 pack.

CONCLUSION.

While these experiments are only in the initial stages it would be imprudent to draw any very definite conclusions from the results, but the effects seem to indicate—

(1) That a great chemical change in the composition of apples takes place in a comparatively short time.

(2) That in consequence the operations of picking and placing the fruit in cool storage to control that process of maturity may have to be undertaken and carried out more rapidly than under present practice, in order to secure maximum life for the fruit in storage.

(3) That red colouring is to some extent misleading when considered from a maturity point of view.

Research on Phormium tenax—The Chairman's report at last month's meeting of the Research Council included the following reference to this subject: "Considering the finance available, the work of the Phormium Research Committee, under Mr. Seifert, and at Massey Agricultural College, shows very favourable promise. Dr. J. S. Yeates reports very promising results from hybrid seedlings. A special assistant has been appointed to investigate yellow-leaf disease, while several investigations into problems connected with preparation and uses of the fibre are being actively pursued."

PASTURE MANAGEMENT.

INTENSIVE GRAZING FOR CANTERBURY CONDITIONS.

M. J. SCOTT and D. J. SIDEV, Canterbury Agricultural College, Lincoln.

It has long been known that all grazing-stock thrive best when the grass is kept moderately short. The ideal state for a pasture is from 2 in. to 4 in. high, and scientists have proved that grass in this young-leaf stage is as highly nutritious as any concentrated food. In order to keep grass in this stage it is necessary to adopt the system of intensive grazing. This is really not a new procedure, having been carried out in the Channel Islands in particular for many years, but it has been brought very much into prominence of late by work and experiments carried out in England and the Continent of Europe.

If farmers are asked at the present time what is the limiting factor in the carrying-capacity of their farms they will mostly reply that it is either the dry spell in the late summer and early autumn, or the period when grass-growth is dormant in winter and early spring (or both). This being so, it must be evident that it is a difficult problem to keep the grass at the best stage of its growth during the spring and summer months, with the number of sheep limited by the carrying-capacity during the period of scarcity. Top-dressing, which is being so largely adopted to increase the quantity of grass grown, although it may give an earlier and a later growth, only serves to intensify this problem of keeping the grass short during the flush season.

Thus it would seem that the better utilization of the existing pasture should be the first consideration of the farmer. When it is found that the maximum return is being obtained from the grass-growth in the flush season, then will be the time to look to methods—such as top-dressing, better strains of pasture plants, &c.—of increasing the amount of grass that grows.

INTENSIVE GRAZING.

Briefly summarized, intensive grazing means putting as many stock as possible on to an area so as to feed off all the grass on it in from two to four days, then shifting the stock on to the next area, grazing it moderately bare in turn, and then moving the stock on again. Then, depending on the number of areas to be grazed and the rate of growth of the grass, in the course of ten days or so the stock are brought back to the first area, made to graze it moderately bare again, and then once again shifted round the other fields. This means that a paddock is grazed hard for three or four days and then completely spelled for eight to fifteen days. This system of grazing means, with the best grassland, having from thirty to fifty sheep per acre on each paddock for the three or four days they are grazing, and eight to twelve sheep on poor country. This, however, does not mean that paddocks have always to be specially subdivided. On country carrying two sheep per acre the acreage of the paddocks requires to be about one-eighth of the number of sheep grazed—for example, 100 acres for 800 sheep. On country carrying six sheep per acre the area of the paddocks should be one twenty-fourth of the number of sheep—thus 10 acres for 240

sheep, or 20 acres for 500 sheep. If the paddocks are already of reasonable or nearly equal size, then concentration of the stock in one or more mobs of such size that they can clean up a field in from three to five days—that is all that is necessary. Supposing a farmer has twelve fields of pasture of nearly equal size, then instead of having his sheep in about six or eight mobs scattered over all the fields he would concentrate them in two mobs, move each mob round four or five paddocks as circumstances might demand, and leave the remaining fields as standbys, to be used ultimately for hay or ensilage.

It is usually found advisable to have two classes of stock to do the grazing. First the highest-producing stock, either ewes and lambs or milking-cows, are allowed to eat the pick of the grass, and then second-class stock, called "followers" (usually dry sheep or cattle, as the case may be), clean up the fields. If the stock available cannot clean the grass up moderately bare, then it is necessary periodically to run the hay-mower over the fields.

By this system of grazing the grass is never allowed to get away to innutritious stem. The chief object of natural plant-growth is to produce seed, and once this object is achieved growth practically ceases for the year and the stock have to live mainly on the low-feed-value seed-stalks. If, on the other hand, this object is defeated by controlled grazing methods, then the plant continues to grow so that it may be able some time to produce seed, and thus not only does the stock have young fresh leafage to eat all the time but a longer grazing-period is also obtained.

Intensive grazing increases the number of stock carried, and entails a greater outlay on conserving winter fodder. At present the stock carried on any farm is *levelled down* to the carrying-capacity of the worst time of the year, whether it is autumn, winter, or spring. Business houses and financiers object, and rightly so, to increasing stock when everybody wants them in flush seasons like the present one, because of the fear of having to sell them on a falling market as soon as a period of scarcity is encountered. To these people the intensive system of pasture management would appear to be objectionable in that it demands more stock. This stock, however, is a permanent increase, and probably one of the greatest benefits to be derived from this system would be doing away with the necessity for dealing in stock in good or bad seasons. Intensive grazing proposes to *level up* the stock carried so as to consume about two-thirds of the maximum growth of grass in the growing-season, and to save the remaining one-third as hay or ensilage for winter fodder for the increased number of stock. Where a man is now carrying 200 sheep, letting his grass go to seed, and taking, say, 25s. net per head from them, we suggest that he can carry between 300 and 400 sheep, keep his paddocks intensively grazed, and take 18s. to 20s. net per head. The difference between 18s. and 25s. being spent in extra labour on saving hay and feeding it out.

It may be said that the saving of this hay or ensilage to improve and increase the food available during times of scarcity, and so indirectly the amount of stock carried, would be uneconomical. If we consider that the present stock carried on a farm is bearing the burden of rates, rent, taxes, &c., then any extra stock will be carried without this burden.

Supposing, for example, a farmer is carrying one sheep per acre on £10-per-acre land, and that his rent or interest, rates and taxes, &c., amount to 10s. per acre, then his present one sheep carries this burden, but any extra sheep are kept without it, and so he can afford to pay 10s. per head extra on their keep.

During last season the College farm wintered 100 old ewes on hay and oat sheaf, together with what little grazing there was on a 20-acre paddock. The cost of extra feed was only 7s. per sheep, so the sheep could be well fed and the labour of hand-feeding easily paid for on 10s. per head. In addition, the margin of 5s. per head, less profit allowed for, over all the sheep carried is more than sufficient to cover the cost of feeding even in the worst seasons. The net profit after making these deductions of 5s. per head for all sheep and 10s. for extra sheep wintered is about 75 per cent. greater than would be made with the lesser number as carried at present.

One ton of hay will winter ten sheep for four months, and if 10s. per sheep is allowed for winter keep this puts the hay value at £5 per ton, and at this price a 2-ton-per-acre crop of hay gives a return that is worth while. Then in seasons like the present a farmer would be able to put aside nearly twice the usual hay crop, part of which could always be carried on as an insurance against a future bad season.

Under Canterbury mixed-farming conditions the whole organization of the farm is utilized for saving the grain crops in good condition, extra labour is employed, and the cost is borne because an immediate cash return is in sight. The conservation of winter fodder, however, is not treated in the same serious manner, and is often a matter of chance, largely because the cost looks prohibitive and there is no immediate cash return. When the final results from this saved winter feed, especially if it is in good condition, are made really apparent, then the operation of saving the feed can be undertaken as keenly as harvesting, and the returns will be equally pleasing.

SOME OBJECTIONS TO INTENSIVE GRAZING.

Several objections are raised against this system of grazing, and one is the fact that there is a tendency for the fields to become foul. In actual practice, however, this tendency is not nearly so marked with true intensive grazing, as the fields have a relatively long spell during which the effect of the rain or the heat is to clean the fields, especially where sheep are grazed. The use of a scattering harrow may be necessary occasionally with sheep, and it is essential with cattle on account of the size of the droppings. On the other hand, with extensive grazing or badly carried out intensive grazing this cleaning-up is seldom allowed to take place.

Another objection levelled against intensive grazing is that it induces scouring; but here again, where the system is carried out effectively, practice would seem to disprove this. With intensive grazing the stock are always getting much the same class of feed— young fresh grass—whereas with extensive grazing, changes in feed due to weather conditions, varying types of pasture, and grass-growth are more likely to have an upsetting influence. While on this point it

may be pointed out that scouring due to rust poisoning (if such a term is correct) would not occur on intensively grazed paddocks, owing to the absence of rust from young stemless grass.

That disease will be more prominent on intensively grazed paddocks is also a theory held by some farmers; in actual practice, however, the opposite is often found to be the case, as during the spelling-period the pasture gets a proper chance to clean up. Much of the disease at present found in flocks or herds is due to unsuitable feeding at some period, and so the balancing of the feeding, by intensive grazing and saving more reserve fodder, will help to eliminate some of the stock-diseases now present.

EFFECT OF INTENSIVE GRAZING ON GRASSLANDS.

Many farmers, especially in Canterbury, hardly realize the great possibilities in grassland farming. At present a fairly common practice is to crop a piece of land until it is full of weeds and will no longer produce a payable cereal crop, and then sow it down in grass to give it a spell, during which time it builds up its fertility again. Under this system of sowing down, combined with bad grazing, it is hardly any wonder that pastures run out even on good land. On the other hand, if the land in good heart were to be sown down to grass, and the grass grazed intensively, there would be not nearly the same trouble with the grass going out and weeds coming in. The returns to be obtained would be as profitable, if not more so, than those from any other branch of farming, and the soil would be built up instead of being depleted. In regard to pastures "running out," one often hears it said, especially in Canterbury, that red clover disappears from the pastures after two or three years. The cause of this disappearance may be partly due to unsuitable strains of clover, but it can also be traced to the grazing methods. Clover-plants do not like shading, and our present system of grazing, under which the grass is allowed to produce flower-stalks, thus shading the clovers, is one reason why the latter die out. Any farmer who has cut hay off the same field for several years in succession has probably noticed that after the second or third year the clovers and fine grasses which will not stand shading have died out, and that coarse grasses have taken their place. Much the same thing happens with extensive grazing.

Again, when the grass is allowed to run to seed-stalks it stops growing and dries up just about the time the red clover is coming into prominence. The sheep avoid this stemmy grass and graze on the clover only, never giving it a chance to produce any leafage; consequently it cannot build up a strong rooting-system and is eaten out.

EXPERIMENTAL WORK AT LINCOLN.

An experiment has been carried out on a field of 12 acres at the College during the past few months, and the results so far obtained are very gratifying. Four acres of the field were grazed under the old system of grazing, care being taken to get the maximum return possible under this system, and it carried sheep at the rate of six sheep per acre from 10th October to 14th January. After being spelled for a fortnight following the latter date there was only fair feed on this area. The remaining 8 acres were divided into eight 1-acre sections,

and two mobs of ewes and lambs each grazed rotationally on four sections, dry sheep being used as occasion demanded to clean up the surplus pasture. These sections averaged $10\frac{1}{2}$ sheep per acre over the above-mentioned period, and at time of writing there is still an excellent growth of fresh clover and rye-grass on them, so much so that an experiment is being carried out in the fattening of lambs on this pasture. In the first grazing experiment we obtained an increase of 169 lb. of live-weight lamb per acre during the period mentioned from the extensively grazed area, and 264 lb. live-weight lamb increase per acre from the intensively grazed area, or an increment of about 56 per cent.

It is hoped next year to widen the scope of this work, so as to include various types of pasture and soil and various classes of stock. It is also pleasing to note that in those few instances in Canterbury where intensive grazing is being done the farmers concerned are well pleased with the results. Information regarding any such practical experiences will always be appreciated.

CONCLUSION.

An attempt has here been made to show how the system of intensive pasture management can be made use of—particularly on mixed farms in Canterbury—for increasing the cash returns from stock in general and from sheep in particular. It is necessary in an article of this kind to make general statements, and although every farmer has particular circumstances that decide his course of action, if he follows the outlines of the scheme we feel sure that the results—in the increase of stock carried, in the improved condition of this stock, and in the better pastures that must ultimately be established—will more than repay him for his extra labour and care.

As sheep-farming is the more important branch of animal husbandry in Canterbury, references in this article are mostly concerning sheep. However, with certain limitations, what is true of sheep is also true in the main of cattle.

CERTIFICATION OF GRASS AND CLOVER SEED.

"It has been hoped that opportunity would be afforded this year to carry out considerable certification of at least white clover and brown-top," reports the Director of the Plant Research Station, "but circumstances will only allow of a certain amount of old-pasture white-clover certification. This work is connected up with the Welsh and Scottish Plant Breeding Stations, and seed from all certified crops is to be put on trial by these institutions as well as in New Zealand. On the area at Palmerston North over one hundred commercial samples of brown-top are being grown, and it is obvious that several very distinct strains are present, and the comparative merits of these require to be worked out before any satisfactory certification can be adopted. In addition it may be mentioned that among these samples there are three which consist almost entirely of true *Agrostis stolonifera*. This seed at the present time is not in the trade in any part of the world, and South German bent-grass (which contains only a small percentage of true *stolonifera*) commands 6d. per pound premium over New Zealand brown-top for that reason. It is clear that where *stolonifera* could be marketed as such it would command a quite fancy price, and in order that this might be done certification based on actual examination of the growing crop is necessary."

CLEANLINESS OF THE CREAM-SEPARATOR.

DEMONSTRATED AS ESSENTIAL TO KEEPING-QUALITY OF CREAM AND SEPARATED MILK.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Bacteriologist, Wallaceville Laboratory.

THE separator is one of the most important links in the chain of good cream-production. It cannot be too strongly emphasized that the whole chain is just as strong as its weakest link, and that the links extend from the supplying dairy to the pasteurization plant at the factory.

The most important points in the production of good cream to consider are—(1) The cleanliness of the milking-machine; (2) the cleanliness of the separator; (3) the cleanliness of the cream-can. Of these points the separator is a very important item, as it is capable of having a most harmful effect if improperly cleaned and looked after.

The process of separation always slightly increases the bacterial count of milk—however clean the separator may be kept—by breaking up the chains and clumps of germs that may have entered from the milking-machine, or that may have originated in the cow's udder. This, however, makes little difference to the keeping-quality of the cream, though it makes a rather marked difference to that of the separated milk. It must be remembered that the separator is a centrifugal machine, and that the tendency is for a large proportion of foreign bodies in the milk, among which may be included bacteria yeasts and moulds, to leave the separator with the heavier skim-milk rather than with the lighter cream, or else to remain in the slime which is always to be found adhering to the bowl and plates of the separator after use.

For reasons already explained, this slime contains a large proportion of the germs originally present in the milk, more particularly the larger bacilli, most of which are bad "weeds" in dairy-produce and cause the worst ultimate effects, usually leading to rapid putrefaction rather than to normal clean souring.

Germs, of the bad type particularly, are collected from day to day in the course of separation, and provide an ever-increasing contamination of the cream. The necessity of taking down the separator and cleaning it thoroughly after each use is therefore quite obvious.

CLEANING THE SEPARATOR.

Apart from removing the slime or more visible dirt, every part of the separator that comes into contact with the milk or cream should be thoroughly washed and cleaned, and finally scalded. This removes the film of milk that remains over all the parts of the separator through which the cream or milk passes.

This thin film of milk, if allowed to remain, forms one of the best media for bacterial growth and multiplication, and the few germs that may have been introduced into the separator with cleanly

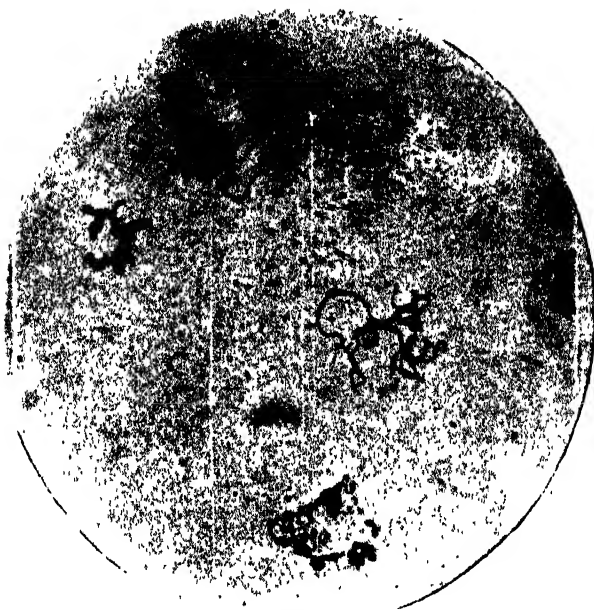


FIG. 1. TYPE OF BACTERIAL CHAIN WHICH IS BROKEN UP BY ACTION OF SEPARATOR AND DISTRIBUTED THROUGH THE BODY OF CREAM AND SEPARATED MILK. (HIGHLY MAGNIFIED)



FIG. 2. SHAKE CULTURE SHOWING A GOOD BACTERIAL COUNT (WHITE DOTS) PER 1 CUBIC CENTIMETRE OF CREAM.

produced milk will reproduce rapidly before the time the separator is next used, forming a considerably increased source of contamination for the following separation. Again, if this film is allowed to remain for a period of several days, and is continually being replenished by fresh cream and milk already containing bacteria, the number of germs or bacteria in the separator itself will be sufficient to cause the cream to sour or develop bad flavours very shortly after separation. Experiments recently carried out at the Wallaceville Laboratory show the degree in which a badly cleaned separator can increase the germ content and reduce the keeping-quality of the cream and separated milk.



FIG. 3. CULTURE SHOWING A MEDIUM BACTERIAL COUNT.

REASONS FOR AND ADVANTAGES OF STERILIZATION.

Thorough cleaning and scalding, as will be shown in the tables to follow, very markedly increase the keeping-quality of the cream, and a further considerable increase can be obtained by steam-sterilizing for half an hour, at as near boiling-point as can be managed, all parts of the separator through which the cream or milk passes. This can usually be done quite simply by placing a convenient receptacle with a perforated bottom and a lid over a copper, allowing the steam to enter and keep circulating for half an hour. It must be remembered that however clean utensils may appear after washing, it is impossible to wash them free from germs, and that most germs found in dairy-produce are capable of resisting scalding water for a considerable time. The only sure way of rendering utensils sterile is by using live steam for a sufficient length of time, and experiments have shown that half an hour is the minimum time in which thorough sterilization may be

expected. Results have shown that sterilization will add an additional day and a half to the keeping-quality of cream above that of the well cleaned and scalded separator.

Experiment with Separator at Wallaceville.

The appended tables were compiled from the results of experiment with two series of samples taken during the same fortnight, in warm weather, during which the temperature varied from 65° to 78° F. Samples were taken from the milk before separation as control samples; samples of the first separated milk to leave the separator and of the first cream were then taken; samples of the final cream and final separated milk were also taken, and finally of the slime remaining in the separator after use. In each case the separator was well cleaned before starting the series, and thoroughly sterilized.

The first series shows the results of leaving the separator uncleaned from day to day; the second series shows a very marked improvement when washing and scalding are carried out from day to day, and also indicates the extra keeping-quality obtained by washing and sterilizing by live steam after use.

Table 1.—Separator sterilized at Start of Experiment, then left.

Sample.	Bacterial Count per Cubic Centimetre	Condition.	
<i>First Round.</i>		At 4 Days	At 5 Days.
Milk	80	Sour .. ..	.. ..
First cream	170	Sweet	Sweet
First separated milk	3,240	Sour .. ..	.. ..
Last cream	100	Sweet	Sour.
Last separated milk	3,400	Sour .. ..	.. ..
Slime from plates	110	.. ..	.. ..
Wash-water	130	.. ..	.. ..
<i>Second Round.</i>		At 3 Days	At 4 Days.
Milk	100	Sour .. ..	.. ..
First cream	9,800	Sour flavour	Sour.
First separated milk	6,000	Sour .. ..	.. ..
Last cream	9,600	Sour flavour	Sour
Last separated milk	20,400	Sour flavour	Sour.
Slime	2,400	.. ..	.. ..
<i>Third Round.</i>			
Milk	60	Sweet .. ..	.. ..
First cream	600,000	Sour .. ..	.. ..
First separated milk	452,000	Sour .. ..	.. ..
Last cream	Uncountable	Sour .. ..	.. ..
Last separated milk	500,000	Sour .. ..	.. ..
Slime	198,400	.. ..	.. ..
<i>Fourth Round.</i>			
Milk	130	Sweet .. ..	.. ..
First cream	650,000	Sour .. ..	.. ..
First separated milk	500,000	Sour .. ..	.. ..
Last cream	Uncountable	Sour .. ..	.. ..
Last separated milk	Uncountable	Sour .. ..	.. ..
Slime	390,500	.. ..	.. ..
<i>Fifth Round.</i>		At 2 Days.	At 2½ Days.
Milk	80	Sweet	Sweet.
First cream	500,000	Sweet	Sour.
First separated milk	650,000	Sour .. ..	.. ..
Last cream	Uncountable	Sweet	Sour.
Last separated milk	Uncountable	Sour .. ..	.. ..
Slime	300,000	.. ..	.. ..

Table 1—continued.

Sample.	Bacterial Count per Cubic Centimetre.	Conditions.	
<i>Sixth Round.</i>		At 1½ Days.	At 2 Days.
Milk	120	Sweet	Sweet.
First cream	800,000	Sour .. ..	..
First separated milk	750,000	Sour .. ..	..
Last cream	Uncountable ..	Sour .. ..	..
Last separated milk	Uncountable ..	Sour .. ..	..
Slime	280,000	.. ..	..
<i>Seventh Round.</i>		At 1 Day.	
Milk	180	Sweet .. ..	..
First cream	Uncountable ..	Sweet .. ..	..
First separated milk	Uncountable ..	Sour .. ..	..
Last cream	Uncountable ..	Sweet .. ..	..
Last separated milk	Uncountable ..	Sour .. ..	..
Slime	Uncountable ..	.. ..	..
<i>Eighth Round.</i>		At 1 Day.	
Milk	90	Sweet .. ..	..
First cream	Uncountable ..	Sour .. ..	..
First separated milk	Uncountable ..	Sour .. ..	..
Last cream	Uncountable ..	Sour .. ..	..
Last separated milk	Uncountable ..	Sour .. ..	..
Slime	Uncountable ..	.. ..	..
<i>Ninth Round.</i>		At 1 Day.	
Milk	190	Sweet .. ..	..
First cream	Uncountable ..	Sweet .. ..	..
First separated milk	Uncountable ..	Sour .. ..	..
Last cream	Uncountable ..	Sour .. ..	..
Last separated milk	Uncountable ..	Sour .. ..	..



FIG. 4. CULTURE SHOWING BAD BACTERIAL COUNT (SMALL WHITE DOTS), TOGETHER WITH MOULDS (TO RIGHT AND LEFT), AND THREE LARGE COLONIES OF *BACILLUS SUBTILIS* (ABOVE CENTRE).

Table 2.—*Separator sterilized at Start of Experiment, then taken down and washed and scalded after each Round.*

Sample.	Bacterial Count per Cubic Centimetre.	Condition.		
<i>First Round.</i>		At 3 Days.	At 4 Days.	At 5 Days.
Milk ..	200	Sweet ..	Sweet ..	Sweet.
First skim-milk ..	6,000	Sour ..	..	..
First cream ..	260	Sweet ..	Sweet ..	Sweet.
Last skim-milk ..	2,560	Sour ..	..	..
Last cream ..	230	Sweet ..	Sweet ..	..
Slime ..	700	..	..	..
<i>Second Round.</i>			At 3 Days.	
Milk ..	1,680	..	Sour ..	..
First skim-milk ..	3,680	.. *	Sour ..	..
First cream ..	1,300	..	Sour ..	..
Last skim-milk ..	7,040	..	Sour ..	..
Last cream ..	1,800	..	Sour ..	..
Slime ..	5,280	..	..	..
<i>Third Round.</i>		At 2 Days.	At 3 Days.	At 4 Days.
Milk ..	180	Sweet ..	Sweet ..	Sweet.
First skim-milk ..	2,040	Sweet ..	Sweet ..	Sour.
First cream ..	1,340	Sweet ..	Sweet ..	Sour.
Last skim-milk ..	900	Sweet ..	Sweet ..	Sour.
Last cream ..	1,200	Sweet ..	Sweet ..	Sour.
Slime ..	760	Sweet	Sweet	Sour.
<i>Fourth Round.</i>				
Milk ..	220	Sweet ..	Sweet ..	Sour.
First skim-milk ..	3,680	Sweet ..	Sour ..	Sour.
First cream ..	1,250	Sweet ..	Sweet ..	Sour.
Last skim-milk ..	4,200	Sweet ..	Sour ..	Sour.
Last cream ..	1,200	Sweet ..	Sweet ..	Sour.
Slime ..	330	..	..	..
<i>Fifth Round.</i>		At 3 Days.	At 4 Days.	At 5 Days.
Milk ..	140	Sweet ..	Sweet ..	Sour.
First skim-milk ..	2,200	Sweet ..	Sour ..	..
First cream ..	1,300	Sweet ..	Sweet ..	Sour.
Last skim-milk ..	1,250	Sweet ..	Sour ..	..
Last cream ..	1,230	Sweet ..	Sweet ..	Sour.
Slime ..	200	..	..	..
<i>Sixth Round.</i>		At 3 Days.	At 4 Days.	At 5 Days.
Milk ..	340	Sweet ..	Sweet ..	..
First skim-milk ..	2,500	Sweet ..	Sour ..	..
First cream ..	1,020	Sweet ..	Sweet ..	..
Last skim-milk ..	1,720	Sweet ..	Sour ..	..
Last cream ..	540	Sweet ..	Sweet ..	..
Slime ..	1,860	..	..	..
<i>Seventh Round.</i>				
Milk ..	59	Sweet ..	Sweet ..	Sour.
First skim-milk ..	810	Sweet ..	Sour ..	Sour.
First cream ..	140	Sweet ..	Sweet ..	Sour.
Last skim-milk ..	180	Sweet ..	Sour ..	..
Last cream ..	50	Sweet ..	Sweet ..	Sour.
Slime ..	680	..	..	..
<i>Eighth Round.</i>				
Milk ..	110	Sweet ..	Sweet ..	Sour.
First skim-milk ..	1,920	Sweet ..	Sour ..	..
First cream ..	270	Sweet ..	Sweet ..	Sour.
Last skim-milk ..	300	Sweet ..	Sweet ..	Sour.
Last cream ..	230	Sweet ..	Sweet ..	Sour.
Slime ..	1,360	..	..	..

Table 2—continued.

Sample.	Bacterial Count per Cubic Centimetre.		Condition.			
<i>Ninth Round.</i>						
Milk ..	46	Sweet ..	Sweet ..	Sour.		
First skim-milk ..	780	Sweet ..	Sour ..			..
First cream ..	680	Sweet ..	Sweet ..	Sour.		
Last skim-milk ..	230	Sweet ..	Sweet ..	Sour.		
Last cream ..	380	Sweet ..	Sweet ..	Sour.		
Slime ..	2,320	..	..	..		..

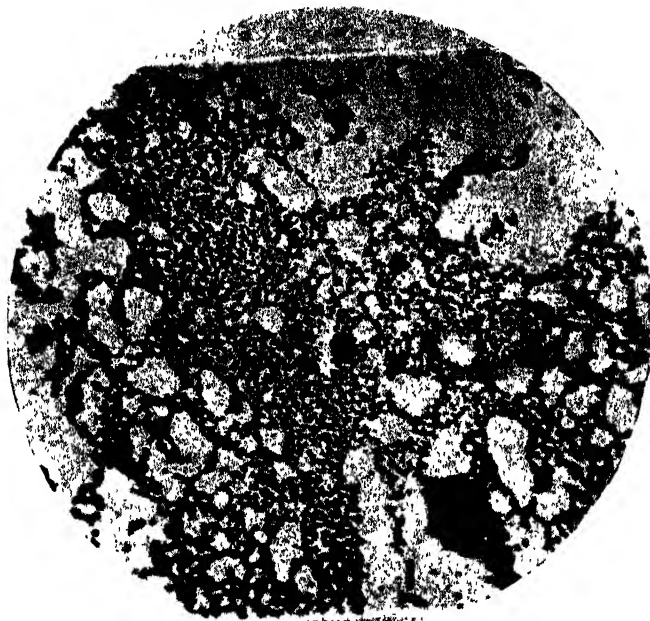


FIG. 5. CULTURE OF BACTERIUM COLI. (HIGHLY MAGNIFIED.)

This is one of the commonest and worst contaminations, frequently caused by dirty utensils and separators. A frequent cause of gassy fermentation in cream.

It will therefore be seen that separators should be thoroughly cleaned and scalded. This means little extra time and trouble, and will greatly improve the quality of the cream. Sterilization of all parts of the separator, wherever possible, is also strongly to be recommended.

Export of Purebred Dairy Cattle.—During the calendar year 1928 seventy-six head of purebred dairy cattle were exported from New Zealand. Of this total four went to New South Wales, ten to Victoria, four to Fiji, four to New Caledonia, fifty-one to Tonga, and three to Samoa.

BLOOD SCOURS IN CALVES DUE TO COCCIDIOSIS.

LOCAL OCCURRENCE DETERMINED.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

FOR some time past officers of the Live-stock Division have been suspicious that bloodstained scouring in calves in some of the dairying districts might possibly be due to a parasitic disease known as coccidiosis.

Recently a farmer in the Hutt Valley, near Wellington, brought in a small quantity of fæces from such a case, giving the following history: Several years ago the majority of his calves died in a small paddock set aside for calves. This paddock was not abnormally damp in winter, but water did lie about to some extent; during the summer the paddock was dry. Deaths occurred in the summer and early autumn. Following the first mortality, several of his calves died annually, until three years ago he gave up trying to rear calves. Every calf that died did so with symptoms of dysentery. This year he had two calves he wished to save, and put them back into the same calf-paddock. Both died, though no calves had been in the paddock for three years. As far as this farmer has noticed, there have been no cases of persistent scouring in his adult herd.

Fortunately I was able to secure the intestines of the last calf to die, and easily demonstrated typical coccidiosis—an ulceration of the rectum due to the entrance, into the cells of the mucous membrane, of this parasite, a species of *Eimeria*, probably *Eimeria Zurnia*. The fæces also contained many of the resistant stage of the organism, known as the oocyst.

The life-cycle of this parasite is an interesting one. The oocyst is dropped on to the ground with the fæces. In it four daughter cells form, which divide again into two sporozoites. At this stage the parasite has been swallowed by another calf, and the sporozoites, of which there are now eight, in the original oocyst are set free and attack the cells of the mucous membrane, one sporozoite to one cell. These sporozoites enlarge, and in them many asexual bodies known as merozoites are found, each of which attacks a new cell when liberated, so setting up the ulceration. If conditions become unfavourable for the parasite after several asexual cycles female elements are formed, the male fertilizing the female to form the oocyst, a very resistant body and the one which is left on the ground in calf-paddocks to infect future generations. An oocyst has been known to remain alive and able to infect for at least two years.

Calves affected are not easily treated. In Canada the following mixture is prescribed: Sulphate of iron, two parts, sulphur, two parts; salt, six parts. They use 50 lb. of the mixture with 100 lb. of linseed-cake to 100 head per day, and continue treatment for two weeks, which works out at $\frac{1}{2}$ lb. of tonic to 1 lb. linseed-cake per calf per day. Other workers claim results with enemas of 1 per cent. tannic acid

or 1 per cent. alum. For poultry, thymol is given in the drinking-water; with calves a dram of thymol dissolved in the milk might be tried for a period of four days, followed by a dose of castor-oil.

Prevention is also difficult unless particular care is taken. It is best to provide an entirely new calf-paddock, and to use new feeding-tins, &c. If necessary to retain the old paddock, it must be thoroughly ploughed and well limed right to the fence-line. Sheds also require to be sprayed with a 1-per-cent. solution of disinfectant such as Jeyes fluid.

In order that we may find out exactly which species of *Eimeria* (*Coccidium*) infests New Zealand calves, farmers having cases of blood scours are requested to let the nearest Stock Inspector know, so that specimens may be forwarded to Wallaceville. Not all cases of blood scours are due to this parasite, but the specimens forwarded will assist in deciding what the proportion is. Farmers should bear in mind that the condition, once present on the farm, requires energetic measures in order to combat it.

OCCUPATION AND UTILIZATION OF LAND IN NEW ZEALAND, 1927 AND 1928.

THE following table summarizes the condition of occupied land in New Zealand for 1927 and 1928:—

	1927.	1928.
	Acres.	Acres.
Orchards, market gardens, vineyards, nurseries, and seed-gardens	31,252	31,416
Field crops	1,769,862	1,689,369
Area occupied by residences, outbuildings, gardens, &c.	64,783	68,566
Fallow land	124,003	124,187
Sown grasses	16,680,348	16,871,530
<i>Phormium tenax</i> (New Zealand flax)	69,420	66,492
Tussock and other native grasses	14,197,853	14,091,717
Fern, scrub, &c.	4,123,743	3,976,134
Plantations—		
Conifers	139,087	200,513
Eucalypts and broad-leaved trees	21,101	31,570
Standing virgin bush	4,099,032	4,000,683
Barren and unproductive land	2,267,214	2,303,277
Totals	43,587,698	43,455,454

In this table "barren" land is defined as that which is incapable of being put to profitable use, and not merely that which is barren because unused. Types of this land are mountain-tops, cliff-faces, shingle-beds, &c. It must be recalled that this table does not profess to give the condition of all land, as the total area of the Dominion is 66,390,262 acres, whilst the area occupied in 1928 was returned as 43,455,454 acres—a difference of 22,934,808 acres.

—Census and Statistics Office.

FIREWOOD ON THE FARM.

A. R. ENTRICAN, Engineer in Forest Products. New Zealand State Forest Service.

To the farming community, more than to any other group in the Dominion, is a plentiful supply of wood fuel important. The farmer is often located far from a railway-siding, which in its turn may be hundreds of miles from a coal-producing region. This source of fuel, therefore, is denied him except at an almost prohibitive cost, and he must look to his plantations, perhaps to the small patches of native bush hidden away in odd valleys on the farm, or sometimes to adjacent bush and milling operations, for the major portion of his fuel-supply. In urban centres, too, wood remains an important fuel even in the face of competition by gas, electricity, coal, and oil. It is the most widely used of all kindling-materials, and is extensively employed in open fireplaces, in cooking-ranges, and under washhouse coppers.

PLANTING FOR FUEL WOOD.

It is unwise for either rural or urban communities to rely upon the chance growth of trees for their future firewood-supplies. It is not unusual for the farmer and firewood-dealer to be compelled to go farther and farther back each year for their wood, or to cut smaller trees each succeeding year, because the available supply is too small to allow the trees to attain to the proper size for cutting. This condition may be prevented by adequate tree-planting measures, such as those initiated many years ago in Central Canterbury. Here the acute shortage of trees for shelter and other purposes in the early colonizing days promoted the establishment of immense shelter-belts and plantations. To-day both urban and rural communities draw a valuable supply of cheap wood fuel from these woodlots. Yet even here care must be taken that if the cut exceeds the growth new plantations are formed to make up the deficiency and to guard against future shortages.

What has been achieved in Canterbury can be achieved in every other section of New Zealand. There is available for planting a wide range of both softwoods and hardwoods which will yield annually from two and a half to seven cords of wood per acre, according to the species and soil or site quality. Since the average farmstead uses only from five to fifteen cords of fuel wood per annum, it is clear that most settlers will have sufficient inferior land, suitable for tree-growing but not for agriculture, which will maintain a plantation for the continuous supply of firewood. Many farmers indeed possess sufficient inferior land suitable for tree-growing on a much larger scale, which would add to their income in supplying firewood to neighbouring urban centres. Local bodies, too, might with advantage establish plantations for the benefit of the community. This is a common practice in France, where the communal forest is a feature of village life, supplying as it does to the inhabitants both their fuel wood and other timber requirements.

WHAT TO USE FOR FIREWOOD.

For reasons which will become apparent later on in this article, it is best to plant trees which will not only grow fairly rapidly but also produce wood of high density or weight per cubic foot. Undoubtedly for fuel wood alone the eucalypts as a group are the best, but farm plantations will produce such a wide variety of other products than firewood, such as posts, poles, construction and building timbers, &c., that, except where absolutely necessary, trees which will yield them should not be cut for fuel wood alone. Trees yielding woods of high general use are therefore recommended for farm planting. Probably macrocarpa (*Cupressus macrocarpa*) is the best, but detailed information upon this subject and upon the management of plantations can be obtained on application to the Director of Forestry, Wellington, or the Conservator of Forests, Auckland, Rotorua, Palmerston North, Nelson, Hokitika, Christchurch, or Invercargill.

Firewood should come from thinnings or improvement cuttings, which must be made periodically for the purpose of improving growth conditions and the quality of the remaining trees. Thinnings normally include (1) dead and suppressed trees which have been overtopped by others and their growth stopped or retarded; (2) trees diseased or seriously injured by insect-attack (these would include eucalypt trees damaged by scale insects, and insignis pine damaged by the steel-blue sawfly); and (3) crooked, large-crowned, short-boled, and "wolf" trees which are crowding and overtopping others. A properly managed plantation will after ten or twelve years yield on the average about one cord of thinnings per acre annually. If eucalypts are planted for firewood-production alone cutting can probably commence after eight years.

NATIVE BUSH ON AGRICULTURAL LAND.

On farms where small patches of native bush remain on valuable agricultural land, the fuel wood removed from them will meet the expense of clearing, and in other cases, where the weed trees of the native bush have by neglect encroached upon former pasture-land, fuel wood can be obtained in restoring the land to grass. Occasionally, too, some of the fast-growing introduced pines spread over agricultural land. Usually such trees will carry heavy branches and be of little use for rough-sawn timber, &c., so that in bringing the land into productivity again the clearing of the trees will yield a good supply of fuel wood.

LOGGING AND SAWMILLING WASTE.

Although many thousands of cords of firewood are obtained annually from logging and sawmilling waste, usually by sawmill employees and farmers adjacent to the operations, it is just as certain that a much wider market could be developed by direct sales of fuel wood from sawmillers to consumers in both rural and urban centres. Two or more householders can by pooling their orders secure a railway-truck of fuel wood containing about three cords, sufficient to carry them over the winter, at a price which will compete with coal and other fuels, especially for burning in open grates.

SEASON OF FELLING.

On most farms there are odd times when both men and teams are slack, and available for cutting and hauling firewood. Generally there is more spare time in the late autumn, winter, and early spring than at any other time of the year, and although these seasons naturally favour the felling and cutting of trees there is no good reason why, if labour is available, firewood should not be cut at any other time. One of the advantages of winter cutting is that the sprouts from hardwoods will grow during the succeeding spring and summer to such a size as to make them more resistant to winter killing than they otherwise would be; therefore, if reproduction is desired winter cutting is advisable with species which sprout. Winter-cut wood, too, will have become well seasoned for use the following winter. Independent firewood-cutters, however, usually commence operations in the spring and work on to the autumn, so that while the spring-cut wood is fairly well seasoned for early winter use, the autumn-cut material for use in the late winter has had comparatively little seasoning and is often fairly green.

FELLING AND CUTTING.

The method of felling and cutting adopted will depend upon the plantation, &c., and the plan of management in use. Thus, if the felling is part of a thinning operation in a close-spaced plantation the logs may be trimmed and dragged to the edge of the plantation, and there cut into 4 ft. cord wood or other suitable lengths and stacked ready for hauling to the farmhouse, whereas if clear cutting is adopted all three operations of felling, cutting, and stacking are probably most conveniently carried out immediately adjacent to the trees that are felled. When individual sticks are above 6 in. or 8 in. in diameter it is advisable to split them and when over 10 in. to 12 in. to quarter them. In the same way larger logs will be split to a size convenient for seasoning, for handling, and for sawing. Small trees are usually felled and cut into 4 ft. lengths with the axe, while larger trees are felled and cut with both axe and crosscut saw. Independent firewood-cutters sometimes employ power-driven crosscut saws for cutting up large logs. The quantity of wood which can be produced per man per day varies with the species of wood, the skill of the workman, &c. Thus an experienced worker will, in native bush, fell, cut into 4 ft. lengths, split, and stack only about three-quarters of a cord of rata per eight-hour day, whereas, clear cutting in small plantation timber, the same man will fell, cut, and stack as much as three cords of either softwood or hardwood per eight-hour day. The average worker will probably cut little more than half these quantities, so that the cost per cord will on a wage rate of 1s. per hour be about 16s. in the case of rata and 5s. in the case of plantation timber. Independent firewood-cutters, however, commonly receive as high as 10s. per cord for felling and splitting plantation timber, with an extra 2s. 6d. per cord for stacking alongside a road.

COST OF HAULAGE.

Because of its great bulk and weight when green, firewood is expensive to haul, and unless good level roads are available, and prices

are high, due to the market's remoteness from coal-producing regions, it is seldom economical to haul it over long distances. For all practical purposes the cost of team-hauling 4 ft. cord wood on fair country roads may be put at 2s. to 3s. per cord per mile. This is based on a two-horse-team wage-rate of 18s. per day, and from six to nine cord-miles per day (that is, four loads of one and a half cords for one mile or three loads of one and a half cords for two miles). By motor-truck the cost will probably vary from 6d. to 1s. per cord per mile, depending upon the condition of the roads and upon the species and dryness of the wood. When the wood must be hauled over fields, &c., the cost will be considerably higher. A good worker should be able to load or unload 4 ft. cord wood at the rate of three-quarters to one cord per hour.

SEASONING FIREWOOD.

Other things being equal, it is advisable to season firewood before hauling. This is readily appreciated when it is realized that some of the rapidly grown softwoods contain twice as much water as wood when freshly sawn. Proper seasoning will therefore give them greater heating-power, and make them lighter in weight and thus cheaper to handle.

The method of stacking to be adopted will depend upon the rapidity with which it is desired to season the wood. Commonly the wood is stacked in 4 ft. lengths in compact piles resting on two long bed-pieces, a practice which facilitates the measurement of the wood where it is being cut under a contract rate per cord. Seasoning, however, proceeds very slowly in such piles, and a more open type is desirable. The best form is built by placing two 4 ft. bed-pieces on the ground 4 ft. apart, and laying a course of 4 ft. lengths across them at right angles. On top of this course, and again at right angles, two more pieces are placed, and on these in turn another course, and so on until the desired height is attained. A modified form consists of placing alternate courses at right angles but leaving a fair space between the sticks in each course.

The essential to be observed is that a good circulation of air is secured throughout the whole pile, so that its location in an open field or other space free to the wind is preferable to any other. If the ground below can be cleared of vegetation, care taken that it is well drained, and the piles so constructed as to shed as much rain as possible, so much the better. Normally cord wood requires nine to twelve months seasoning, but even three months' good drying weather will reduce its moisture content to a point where it has about 90 per cent. of the fuel value of dry wood. Split wood dries more rapidly than round or unsplit wood, and barked wood more rapidly than unbarked wood.

SAWING AND SPLITTING.

For farm use firewood is normally required in from 8 in. to 18 in. lengths; and, while much of the cord wood and other length timber is still sawn into these sizes by hand, the use of inexpensive saw-tables and attachments for use with farm tractors is increasing. While a good worker will saw 4 ft. cord wood into 16 in. lengths at the rate of one and a half cords per day, a tractor-driven saw attachment will

enable him to work at three or four times that rate and to produce from five to six cords per day. The wood requirements on many farms will not warrant the expenditure on this attachment, but the cutting of supplies for other farmers and perhaps for sale to neighbouring townships may return a profit on the investment. After sawing, the stove wood may require further splitting. Some woods split very easily, but others, such as some of the eucalypts, are fairly difficult to split. Nevertheless a good worker should be able to split two or three cords per day without difficulty.

MEASURING FIREWOOD.

The commonest method of measuring firewood is by the cord, which consists of a pile 8 ft. long by 4 ft. high by 4 ft. deep, and therefore contains 128 cubic ft. of piled wood. After allowing for spaces between sticks, &c., there are from 60 to 100 cubic ft. of solid wood and bark, depending upon the type of firewood—whether it is a soft-wood or hardwood, whether it is round or split, or whether it is trunk or branch wood. Cord wood is sometimes piled 2 in. to 3 in. higher than 4 ft. to allow for shrinkage and settlement. For all practical purposes a cord may be assumed to contain 80 cubic ft. of wood.

HOW TO BURN WOOD.

The secret of efficient wood-burning is to restrict the amount of air passing through the bed of the fire, since wood requires for its combustion only half the amount of air required for the combustion of coal. For this reason in adapting any coal-burning equipment, whether in stove, fireplace, or furnace, it is essential to use either a finer grate or to limit the air-space by placing a piece of sheet iron over a large part of the grate. It may even be advisable to place the fire directly on the base of the fireplace and dispense with the grate.

To keep up a good wood fire it is further necessary to maintain a plentiful supply of ashes. As the blocks burn an accumulation of glowing charcoal forms in the ashes, and keeps on burning slowly, assisting the fresh blocks to ignite. The fire may be banked for many hours by shovelling ashes lightly over all the burning wood. Special wood-burning stoves are in common use, but special attachments are also procurable for the ordinary type of stove. In open fireplaces wood makes an excellent fuel, affording both heat and ventilation. It can also be used economically in combination with coal.

Comparative Heating-value of different Fuel Woods.

DRY WOOD.

As most woods are of the same basic chemical composition, equal weights of wood substance should give about the same amount of heat regardless of the species. In point of fact, the presence of resin, gums, tannins, &c., as well as water present in varying amounts, causes the various woods to have different heating-values, the presence of resins, &c., increasing the heating-power by as much as 12 per cent. The heating-value of thoroughly air-dry wood may, however, be conveniently assumed as averaging about 8,200 British thermal units,

one B.Th.U. being the amount of heat required to raise the temperature of 1 lb. of water through one degree Fahrenheit. A pound of coal will yield widely varying amounts of heat, according to its type. Southland lignite, for instance, will yield only about 6,300 B.Th.U., whereas Waikato or Southland brown coal will yield 10,000 B.Th.U., and Westland bituminous coal about 14,300 B.Th.U. per pound of dry coal, so that dry wood is over 30 per cent. more efficient than Southland lignite, but only fifty-eight per cent. as efficient as Westland bituminous.

DRY VERSUS GREEN WOOD.

In making comparisons between wood and coal, however, it is necessary to take account of the moisture present in both. When any fuel containing water is burned, part of the heat it is capable of yielding must be expended in raising the water to the boiling-point, converting it into steam, and raising this steam to the temperature of the flue gases. To deal with 1 lb. of water in this way requires about 1,220 B.Th.U., and the greater the amount of water present, clearly the more the heat lost. Thus one cord of pondosa pine (*Pinus ponderosa*) when freshly cut will contain in its 80 cubic feet some 1,820 lb. of dry wood substance and some 3,080 lb. of moisture, so that its net heating-value is—

$$\begin{array}{rcl} 1,820 \times 8,200 & = & 14,900,000 \text{ B.Th.U.} \\ \text{minus } 3,080 \times 1,220 & = & 3,800,000 \text{ B.Th.U.} \\ \hline & = & 11,100,000 \text{ B.Th.U.} \end{array}$$

Fairly well seasoned, however, the same cord will contain only 600 lb. of moisture, so that its net heating-value is—

$$\begin{array}{rcl} 1,820 \times 8,200 & = & 14,900,000 \text{ B.Th.U.} \\ \text{minus } 600 \times 1,220 & = & 700,000 \text{ B.Th.U.} \\ \hline & = & 14,200,000 \text{ B.Th.U.} \end{array}$$

The dry cord is therefore $(\frac{14.2}{11.1} \times 100) = 100$, or 28 per cent. more valuable as a fuel than the green cord, and demonstrates the value of seasoning firewood.

WOODS GROUPED BY THEIR HEATING-VALUES.

Since the heating-value of 1 lb. of thoroughly dry wood substance is approximately constant, irrespective of the species, it follows that the greater the density or weight per cubic foot of a wood the greater its heating-value per cubic foot or per cord. As a great deal of firewood is commonly measured and sold on a cord basis, it is convenient to classify the various woods on a density basis and to compare their heating-values.

Group 1.—This, the most valuable group, averages about 50 lb. of dry wood substance per cubic foot, and includes the heavy native hardwoods as follows:—

Northern rata (*Metrosideros robusta*).
Southern rata (*Metrosideros lucida*).
Black maire (*Olea Cunninghamii*).

Puriri (*Vitex lucens*).
Pohutukawa (*Metrosideros tomentosa*).
Manuka (*Leptospermum* spp.).

Group 2.—This next group averages about 38 lb. per cubic foot, and includes the beeches (*Nothofagus* spp.), with the exception of the silver-beech (*N. Menziesii*).

Group 3.—The third group comprises the lighter native hardwoods, the heavier native softwoods, and some of the heavier introduced eucalypts (hardwoods), their average density oven-dry being about 32 lb. per cubic foot, and the principal species being as follows :—

Native Hardwoods.

Tawa (*Beilschmiedia tawa*)
Taraire (*Beilschmiedia taraire*)
Kamahi (*Weinmannia racemosa*).

Native Softwoods.

Matai (*Podocarpus spicatus*).
Miro (*Podocarpus ferrugineus*).
Rimu (*Dacrydium cupressinum*)
Kauri (*Agathis australis*).

Introduced Hardwoods.

Blue-gum (*Eucalyptus globulus*).
Peppermint-gum, &c. (*Eucalyptus amygdalina*).

Group 4.—In the fourth group fall the light native hardwoods and softwoods, the heavier introduced softwoods, and the lighter eucalypts, their average density oven-dry being about 26 lb. per cubic foot, and including the following species :—

Native Hardwoods.

Silver-beech (*Nothofagus Menziesii*).

Native Softwoods

Kahikatea (*Podocarpus dacrydioides*).

Introduced Hardwoods.

Tasmanian Stringybark (*Eucalyptus obliqua*).

Introduced Softwoods.

Macrocarpa (*Cupressus macrocarpa*)
Insignis pine (*Pinus radiata*).
Corsican pine (*Pinus laricio*).

Austrian pine (*Pinus austriaca*).
Douglas fir (*Pseudotsuga Douglasii*).
European larch (*Larix Europea*).

Of these probably macrocarpa is the best.

The choice of wood for fuel does not, however, depend upon its heating-value alone. There are other factors of importance, such as freedom from smoke, ease and completeness of combustion, rapidity of burning, sparking, &c. Kauri, for instance, tends to smoke badly, and such woods as hinau (*Elaeocarpus dentatus*), pukatea (*I. aurelia novae-zelandiae*), and rewarewa or honeysuckle (*Knightia excelsa*) are so difficult to burn, even when seasoned, that they are seldom used by themselves for firewood. Tawa and taraire burn very rapidly, but are useful in that they will burn when quite green, while totara (*Podocarpus totara*), silver-pine (*Dacrydium Colensoi*), and macrocarpa tend to spark.

HEATING-VALUE OF VARIOUS GROUPS.

Assuming, as in the investigation of the heating-value of dry and green pondosa pine, that fairly well-seasoned firewood contains about 33 per cent. of moisture based on the oven-dry weight of the wood, we find that the net values of the four groups per cord are as follows :—

$$\begin{aligned}\text{Group 1} &= (80 \times 50 \times 8,200) - \left(\frac{80 \times 50 \times 33}{100} \times 1,220 \right) \\ &= (32,800,000 - 1,600,000) = 31,200,000 \text{ B.Th.U.}\end{aligned}$$

Similarly,

$$\begin{aligned}\text{Group 2} &= 23,700,000 \text{ B.Th.U.} \\ \text{Group 3} &= 20,000,000 \text{ B.Th.U.} \\ \text{Group 4} &= 16,300,000 \text{ B.Th.U.}\end{aligned}$$

The relative values of Groups 2, 3, and 4 expressed as percentages of Group 1 are therefore 75, 64, and 52 respectively.

These heating-values can now be used to establish relative prices per cord for the various groups. For every £1 per cord that the buyer is willing to pay for woods in Group 1 he should not pay, if he is obtaining equal heating-value, more than 15s., 12s. 6d., and 10s. for woods of Groups 2, 3, and 4 respectively. Conversely, for every £1 per cord that he pays for woods of Group 4 he will obtain equal heating-value by paying £1 4s., £1 9s., and £1 18s. for woods of Groups 3, 2, and 1 respectively.

COMPARISON BETWEEN CORDS OF WOOD AND TONS OF COAL.

In some coals, such as the Westland bituminous, the moisture content is negligible, but in the lignites and the brown coals allowances of 35 per cent. and 15 per cent. respectively must be made for moisture similar to that in wood. The net heating-values of the various coals per ton are therefore—

Westland bituminous -

$$14,300 \times 2,240 = 32,100,000 \text{ B Th U.}$$

Brown coals

$$(10,000 \times 2,240) - \left(\frac{2,240 \times 15}{100} \times 1,220 \right) = 22,000,000 \text{ B Th U.}$$

Lignite—

$$(6,300 \times 2,240) - \left(\frac{2,240 \times 35}{100} \times 1,220 \right) = 13,100,000 \text{ B Th U.}$$

One cord of seasoned Group 1 woods is therefore equal in heating-value to 1 ton of Westland bituminous coal; one cord of seasoned Group 2 woods equal to 1 ton of brown coal; and $\frac{2}{3}$ cord and $\frac{1}{2}$ cord respectively of seasoned Groups 3 and 4 woods equal to 1 ton of lignite.

DEFINITION OF "CO-OPERATIVE DAIRY COMPANY."

THE following reply was made recently by the Director of the Dairy Division to a correspondent who inquired as to what constitutes a co-operative dairy company—

For the purposes of Part III of the Dairy Industry Act "co-operative dairy company" is defined as follows:—

In this part of this Act the term "co-operative dairy company" means a company which is incorporated under the Companies Act, 1908 (whether before or after the coming into operation of this Act), and the principal object of which is the manufacture of butter, cheese, dried milk, casein, or other article from milk or cream supplied to the company by its shareholders, or the collection, treatment, and distribution for human consumption of milk or cream so supplied to the company.

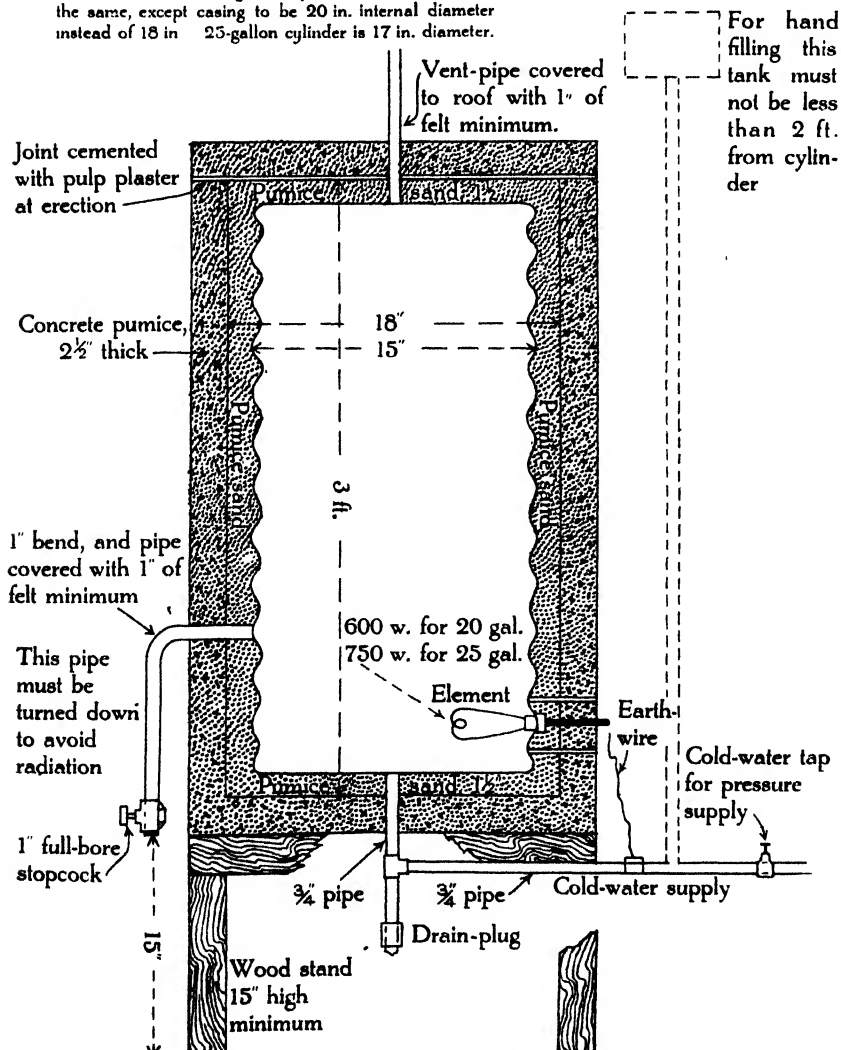
As we understand it, the phrase "the principal object of which," as used above, means that a dairy company in order to qualify for the use of the term "co-operative" should receive from its shareholders at least one-half of the butterfat supplied to the company.

ELECTRIC WATER-HEATER FOR DAIRY-FARMS.

Dairy Division.

In most milking-sheds where electric power is available, especially where the charge for current is on the number of pounds of butterfat produced, the electric water-heater will be found to be a very convenient appliance. Its efficiency will depend upon the construction of the heater and the size of the element provided. Trials conducted by officers of the Dairy Division have shown that the heater illustrated here—the design of which was kindly supplied by the Manawatu-Oroua Electric-power

NOTE.—For 25-gallon cylinder, dimensions are the same, except casing to be 20 in. internal diameter instead of 18 in. 25-gallon cylinder is 17 in. diameter.



Board—gives very satisfactory results, the 20-gallon size being suitable for a four-cow milking-plant. It should be noted, however, that as the heating element does not operate while the motor is running any use made of the power between milkings, such as wood-sawing, &c., will result in the loss of heat in the water for the following milking.

THE CASTRATION OF PIGS.

Live-stock Division.

YOUNG male pigs as a rule are castrated at about four to six weeks of age, and whether intended for bacon or pork it is not advisable to leave them longer than this if the best results are to be obtained by both the raiser and the consumer.

It is preferable to fast the young animals beforehand, or castrate in the early morning. The seat of operation should be washed with a weak solution of Condy's fluid or lysol, and the young pigs allowed to return to the sty, which in the interval should have a clean bed of dry straw provided, in order to prevent the wound coming in contact with the floor or any dirty material which might give rise to sepsis or abscess formation. If straw bedding is not available the pigs should be liberated in a clean grass-paddock.

The incision through the skin and outer coverings of the testicle should be a bold one, extending from one end of the testicle to the other. Such an incision permits proper drainage afterwards, whereas the effect of a small incision is to leave pockets where pus can accumulate. Cleanliness should be observed throughout the operation, the knife being returned to the vessel containing the antiseptic when not in use.

Improper or partial castration, or leaving the animals to mature further before the operation is carried out, results in coarser flesh and even tainted meat. Carelessness in the operation, with abscess formation in the scrotum or in the neighbouring parts may result in condemnation either wholly or partially by the Inspector at the works. It will be realized that abscesses in the region of the scrotum constitute a serious matter, in that the hams are the most valuable part of the carcass.

At the present time too many pigs arrive at the abattoirs and slaughterhouses throughout the country improperly or carelessly castrated, and requiring the attention of the Inspector. Indeed, so prevalent are troubles due to faulty castration that some buyers, in order to protect themselves and their employers, are now examining by palpation all pigs before purchase. There is no compensation for such animals partially condemned on this account, and the buyer is only protecting his firm when buying at a reduced price pigs which with a little care could have fetched the highest market figure.

The losses to the pig industry from this cause must be considerable. It is estimated that 3 per cent. of pigs coming forward may be partially or wholly condemned as a result of improper castration alone. Pig-farmers in their own interests, therefore, should see that reasonable care will amply reward them in the enhanced return from the sale of a sound and wholly marketable product.

SEASONAL NOTES.

THE FARM.

AUTUMN-SOWN WHEAT.

AUTUMN wheat can be taken after grass or clover, rape, cereals, peas, potatoes, or linseed. The crop usually does best after clover or rape; if taken after grass the land should be skimmed early to allow the sod to rot before the wheat is sown. Good crops are often obtained after potatoes, provided sowing is not unduly late.

Wheat requires a fine, firm seed-bed—the fine soil at the bottom and the clods at the top. Small lumps on the surface of a field of autumn-sown wheat are no disadvantage; the clods break down in the winter and provide a loose surface, preventing the land from caking hard in the early spring. Grassland intended for wheat should be skim-ploughed any time between the end of November and the middle of March. After lying for about six weeks the surface should be disked and the land cross-ploughed 6 in. or 7 in. deep. The surface can then be levelled with the harrows, and the final tilth given with the disks and harrows. The cultivator should not be used, as it is inclined to drag any undecayed vegetation to the surface. The two ploughings of grassland for wheat are very necessary, in order to allow the vegetation to decay and to obtain a fine, firm seed-bed. Early skim-ploughing gives virtually a summer fallow, and allows the land to absorb the autumn rains.

Land after peas, rape, linseed, or a cereal can be worked down after ploughing with the harrows, disks, and cultivator. In this case the cultivator is a necessary implement when the land is cloddy, as it brings the clods to the surface and shakes the fine soil to the bottom, thus making a good seed-bed for the crop. Care should be exercised in the use of the roller for breaking clods on wheat land, as it is liable to consolidate the surface and cause it to set. If the roller is used it should be followed with the cultivator to loosen the surface again.

Recent research work has shown that the wheat crop should be manured with 1 cwt. of superphosphate per acre. Manuring at this rate has given increases in yield of 3 to 8 bushels per acre, with an average increase of 5 to 6 bushels. About two-thirds of the wheat in Canterbury is now manured, and a large part of the unmanured area occurs on land where wheat follows grass, as it is generally considered by farmers that land after grass is in a high state of fertility, and does not require fertilizers. Experimental work, however, indicates that wheat taken after grass responds as well to phosphates as wheat taken in any other place in the rotation.

Wheat manured with superphosphate usually ripens one to four days earlier than wheat that is not manured or that sown with

other phosphates. Hence it is often stated that wheat sown with superphosphate "blights off" or does not "carry on." In all experiments, however, where wheat sown with superphosphate has ripened earlier than that sown with no manure or other phosphates there has been a good increase in yield. Also, the greater the hastening in maturity the greater the increased yield. Improvement in yield due to superphosphate may, however, occur without hastening maturity.

Last season's experimental work indicated that nitrogen top-dressing in the spring, in addition to the phosphate application at the time of sowing, is likely to be a sound manurial practice. Further information on this point will be gained when the results of this season's experimental work are published. There is no experimental evidence yet in favour of the use of potash in wheat-manuring.

The common varieties grown in our wheat-growing areas are Solid-straw Tuscan, Hunter's, and Velvet Chaff Pearl. Solid-straw Tuscan is the best wheat for windy districts, as the straw is filled with pith and is very rigid, so that it does not thresh about in the wind. Hunter's is a popular variety for medium wheat-growing soils; it yields well, produces a large amount of green feed, and can be fed off fairly close. Velvet Chaff Pearl is a wheat of very high milling-quality, but is only grown on medium land of even quality where the whole crop will ripen at once, as the grain is loose in the chaff and liable to shake.

For autumn and winter sowing the seeding varies from $1\frac{1}{4}$ to $1\frac{1}{2}$ bushels. The seed should be pickled for stinking-smut control before sowing. The common practice is to use formalin pickle on the farms, but a good deal of the seed is now treated in bulk with copper carbonate. The latter method consists in dry-dusting very finely divided copper carbonate on to the wheat at the rate of 2 oz. per bushel. As the powder is poisonous if breathed in quantity, the dusting is usually done in a closed rotating cylinder. The advantages of this method are that large quantities of seed can be treated by machinery at seed-cleaning plants. The seed may be treated any time before sowing, and the germination is in no way injured.

Wheat will not stand flooding to any extent in the winter-time. Any hollows in the wheat-fields should have surface drains made to carry off any standing water that may collect after rain.

OATS AND BARLEY.

Autumn oats usually follow a cereal or an early fed-off fodder crop. The seed-bed requirements are similar to those already mentioned for the wheat crop. Algerians for chaff and Garton's for grain are the common varieties sown in the autumn. Both varieties produce very palatable green feed in the spring; Algerians can be fed off with the greatest severity, but Garton's should be quickly eaten down once and then left alone. The autumn seeding is $1\frac{1}{2}$ to 2 bushels, and the crop should receive 1 cwt. of super per acre.

Barley for malting is sometimes sown in the autumn, but care must be taken that the land selected is dry in character and situation in the winter, as barley is killed out if the land is subject to winter flooding.

PASTURE MANAGEMENT.

The main points in connection with the early autumn top-dressing of pastures were dealt with in last month's notes. It should be remembered that early top-dressing with quick-acting phosphates, particularly superphosphate, increases the late autumn and early winter production of grass, and hence increases the winter carrying-capacity. Before pastures are top-dressed in the early autumn all rank growth should be grazed or mown off, and the field thoroughly chain- and tripod-harrowed as soon as the droppings have been sufficiently softened by rain to render them easy to spread.

—P. W. Smallfield, B.Ag., *Fields Superintendent, Auckland.*

MINOR OPERATIONS ON YOUNG STOCK.

Nearly every farmer in season castrates and tails his lambs, dehorn's his young cattle, castrates his calves and pigs, and may even perform other operations such as opening abscesses, &c. In every procedure of a surgical nature thorough cleanliness of the site of operation, sterilization of knives and other instruments by boiling, and care and cleanliness with the aid of antiseptic solutions afterwards, are all essential to success. For the young farmer who has not yet undertaken such work a practical demonstration by an experienced man is the best method by which he can acquire technique and success. It is essential before operating that the operator's hands should be thoroughly clean, particular attention being paid to the fingernails.

If any ram lambs are discovered at this season of the year which have straggled or are not required for stud purposes, their castration requires even greater care than that of young lambs operated on at the proper season. It is not always recognized that the castration of a lamb of five or six months of age or older is attended with some considerable risk. A suitable method of castrating such animals is by means of the Burdizzo instrument. If the ordinary method is adopted there is danger of the animal dying either from hæmorrhage or from infection of the scrotal wounds.

HANDLING OF FAT LAMBS.

The handling of fat lambs between the paddock and the killing-pen is a considerable factor in maintaining the quality and value of the exported product. The first consideration is to reduce the time of travelling to a minimum, as prime lambs lose condition very rapidly, especially in hot or muggy weather, and with loss of condition the bloom is not likely to be as good. It is therefore advisable to minimize travelling as much as possible, yarding and loading expeditiously, and forwarding at the time specified by the freezing-works.

Considerable losses occur through lamb carcasses having to be second-graded owing to bruising, which is due to three main causes:

(1) Pulling of the wool ; (2) dogging ; and (3) bad trucking. The first results in numerous hæmorrhagic spots, usually on the back, and detracting much from the appearance of the carcass when dressed. The second often involves severe hæmorrhages of the legs, and sometimes the brisket, possibly causing the rejection of the lamb for export. The results of the third item are shown in broken ribs and legs, and sometimes internal hæmorrhages in the region of the loin and kidneys.

Regarded singly, these faults may not cause much loss to each individual farmer, but at the works the large wastage that occurs is seen at a glance by the rows of rejects.

—*Live-stock Division.*

THE ORCHARD.

EXPORT TRADE.

THE picking of the later varieties will soon be engaging the attention of exporters. While the picking of immature fruit is to be discouraged, it is very necessary that the later varieties should be picked and shipped as soon as ready ; if unduly protracted, there is a danger of this fruit arriving at its destination in faulty condition, and also clashing with the advent on the overseas market of the locally grown new season's fruit. Pears especially should suffer little delay between picking and despatch. Sturmer apples require specially careful handling, as they bruise so readily ; often one sees this variety badly damaged even in the picking. The parts of grading-machines with which the fruit comes in contact, if not cleaned frequently, become coated with the natural grease from the fruit, which in turns picks up grit, causing excessive scratching and marking of the fruit. Such marks are not always apparent at the time, but show up shortly after packing.

Some of the outstanding faults in connection with the preparation of export fruit may also be noted now, and possibly these may be rectified in further consignments. Damage to fruit at the side of the case where the bulge is excessive is caused in lidding. This may be avoided by pressing apples which are more or less resting on the edge of the case towards the centre. End apples are often damaged where the ends are packed too high, especially where through irregular sizing the pocketing is faulty and the pack loses its springiness. The ends may be kept lower by pressing the end apples into position in each successive layer, as this has a tendency to squeeze the apples towards the centre and to build the pack higher there.

The necessity for the use of well-seasoned timber in cases is obvious. However, where exporters are dependent on local supply and arrangements have been made for spread delivery, trouble is often experienced late in the season on account of dry cases having been used up and nothing but unseasoned cases coming to hand. Such cases are debarred from immediate export, and should also be debarred from local cool stores. Where, however, growers are dependent on such supply it is advisable to make the cases up

immediately and stack loosely in the open, preferably out of the sun to avoid warping and splitting, but rather under trees where there is a good draught.

STORAGE OF FRUIT.

Fruit intended for cool storage requires careful grading and packing. Firstly, it is requisite that only fruit of good quality should be selected for storage. It is a doubtful undertaking commercially to store fruit other than of popular sizes or of good colour and appearance. It is foolish to pay heavy storage charges on rubbish; the heavy charges can be carried by first-class fruit only. Fruit intended for long storage should be picked at a stage of maturity not too advanced, and no delay should occur in getting it into store after picking. Grading for the purpose of eliminating damaged fruit should be done carefully and thoroughly, otherwise rots developing in such fruit may spread to sound fruits in contact, causing a considerable decrease in the bulk packed out after storage, and for which full storage charges have been paid. It is advisable not to wrap fruit for cool store, but rather to make arrangements to repack and wrap after withdrawal. Fruit should be looked over at intervals, otherwise certain lines may deteriorate to such an extent as to become unmarketable, though they could have been marketed in sound condition earlier. Larger sizes should be separated in the cool store and made easily accessible for earlier marketing.

The same care and treatment as that given to fruit intended for cool storage should be extended to fruit being held in ordinary storage. Grading out to sizes allows of the disposal of larger sizes and the poorest keepers first. The elimination of damaged fruit should be just as strict, as conditions for the development of rot is more favourable than in cool storage. Fruit held in ordinary storage should be provided with good ventilation, but not subjected to the full blast of winds, otherwise excessive wilt occurs. Frequent cleaning-up of the packing-shed is very desirable, in order to get rid of all reject, diseased, and rotting fruits.

DISEASE CONTROL.

Although the season's spraying operations have in most instances been brought to a conclusion, a little attention here and there may assist greatly in connection with future work. San Jose scale may be noted on certain trees during picking-operations, and should be marked for special treatment when the late dormant sprays are being applied. Odd fireblight infections are often located at picking-time; these should be dealt with at the time, or conspicuously marked and dealt with at the earliest opportunity. Trees affected with silver-leaf might also be marked for removal later.

—N. J. Adamson, Orchard Instructor, Hastings.

Citrus-culture.

With the mild autumn temperature and good rains the citrus-trees will rapidly put forth new growth of rather a soft character. It is desirable that such growth should become hardened before even slight frosts are experienced; therefore nitrogenous fertilizers

should not be applied at this season of the year, or the growth will be even more rapid and soft. Phosphatic and potassic manures should be applied during early April; 8 cwt. of super plus 2 cwt. of sulphate of potash per acre is a good average dressing. This should be distributed prior to the autumn working of the land, so that it may be turned under with the plough.

Seasonal working of the soil should aim at leaving the contour so as to provide an easy get-away for heavy rains which may be expected later. Grading should be done so that no hollows are left to accumulate water near the rooting-area of the trees. Now is a good time to sow a cover-crop for turning under later. Blue lupins are best for the purpose, and provide the greatest bulk of green material to plough in; oats and tares or *Lotus angustissimus* are also quite good. Among young trees, especially where shelter is poor, lupins may be grown right up the trees; they provide quite a beneficial cover.

Where it is intended to extend or plant new areas, orders for trees should be lodged with the nurseryman, as there is likely to be a shortage of citrus-trees during the coming planting-season.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

PREVENTION OF COLDS IN THE YOUNG STOCK.

THE time of year is now approaching when harder weather conditions may be expected. Therefore the matter of making the pullets comfortable by good feeding and special care (as a means of encouraging them to produce dear-season eggs in good numbers) should have first consideration on the part of the poultry-keeper. Even the pullet which is bred to lay in winter will fail to produce sufficiently if everything in the chain of management is not in her favour.

Above all things, care should be taken in every possible way to prevent the young birds from catching colds. The sleeping-quarters should be well ventilated but free from draughts, while on no account should the birds be overcrowded. Neglect of these important details is only inviting trouble in the form of colds, the forerunner of that dreaded disease roup. The most common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dust and dirt usually adhere. Once a cold makes its appearance in the flock every endeavour should be made to find the cause and remove it at the earliest possible moment, while isolation of the affected birds is the only safe course. A good plan at this time of the year to prevent colds is to place some Condry's crystals into the drinking-water. Put half a teaspoonful of the crystals into a pint bottle of water, and add a teaspoonful of this mixture to about 2 quarts of drinking-water.

It may be repeated that the aim of the poultry-keeper should be to prevent even a slight cold from making its appearance, by removing all sources favourable to its development. It should be

remembered that the curing of colds involves considerable labour, and that even when a cure is effected the trouble is likely to recur at any time unless the cause is removed. A cold may be treated successfully, but once the roup stage has been reached (indicated by offensive breath and a swelling or cheese-like substance protruding from the eye) it will usually pay to destroy the bird at once rather than attempt to doctor it. A simple method of treating colds is to take a shallow dish, fill it with pure kerosene, and dip the bird's beak in this sufficiently deep to cover the nostrils. Hold the bird in this position till it breathes. This will have the effect of drawing the kerosene to the base of the trouble. Repeat the treatment on alternate days until a cure is effected. In applying this treatment care must be taken to prevent the kerosene from getting on the face of the bird, as it is apt to have an injurious effect. The nostrils should be covered and no more, while the dipped parts should be wiped with a dry cloth after immersion.

MOULTING OF PULLETS.

Disappointment is often experienced at this period of the year owing to pullets going into a moult from no apparent cause, and just when the market value of eggs is on the upgrade. This is usually due to underfeeding, or the supplying of food which is not palatable to the birds; it may also be brought about through moving the birds from one house to another. Especially is this the case when the pullets have commenced to lay or are on the point of laying. This implies that all pullets bred to lay in winter should be placed into their permanent quarters without delay. In addition the treatment they receive must be regular and uniform to a degree. Of course, as a general rule, the very early hatched birds, particularly of the lighter breeds, will lay a few eggs in the autumn and moult with or before the adult stock, and this very often regardless of having received the best possible management. Usually when pullets go into an early moult their owners adopt the plan of changing the food, under the impression that the food is responsible. This is a mistake (providing, of course, that the food is sound and palatable), as putting the birds on a new diet will only make matters worse. A bird will always come back to lay much quicker when there is no drastic alteration in her treatment. The treatment may be all right, but any change will not improve matters. Pullets when commencing to lay usually possess a nervous temperament, and any alteration in the methods under which they are kept will cause them to fret, and thereby intensify any unfavourable condition to which they have been subjected.

CROSSBREEDS VERSUS PUREBREEDS.

Inquiries frequently reach me as to the best breeds to cross with a view to producing heavy-laying stock. This is a question that cannot be answered with any degree of satisfaction, for at the best the crossing of different breeds may be regarded as a hit-or-miss system of breeding, as compared to breeding from fixed types of purebred strains. It is a common but a mistaken opinion, when profitable egg-production is to be maintained, that the crossbred

bird is better to keep for this purpose than the one from pure-bred parents of one particular breed. An argument often brought forward in support of crossbreeding is that the chickens will usually grow better, and generally make greater progress than purebreds. Maybe they do, and will return an equal profit, but only when size and table qualities are the chief objects aimed at. With regard to heavy egg-production, however, we have no proof that the cross-bred bird can be bred with any degree of certainty for this special purpose.

On the other hand, the records put up in the egg-laying competitions give striking proof of the value of various purebreds for high egg-production. It must be admitted that many of the birds which have produced high egg-records at the competitions, and which were generally regarded as purebreds, gave striking evidence that foreign blood had been introduced as a short-cut to heavy egg-production. There is also striking evidence that many of these birds with mixed blood have failed to produce their like when placed in the breeding-pen, and as a result became a source of annoyance and disappointment to breeders into whose hands they fell. It is not the number of eggs laid by the bird which determines her real value, but the power to transmit her laying-powers to her offspring. Many valuable lessons in regard to the management of poultry have been taught per medium of the egg-laying competitions, and probably the most important one yet demonstrated is the great superiority of purebred stock as compared with crossbred or barnyard fowls.

THE BREEDING COCKERELS.

Many poultry-keepers, after selecting the most promising cockerels for future breeding-purposes, place them in small coops or confined quarters. In order that the birds may make special growth they then provide them with plenty of rich nourishing food, and give them special care and management. This is a mistake, as such conditions do not tend towards promoting vigorous and healthy growth. It stands to reason that feeding rich foods to a bird and curtailing its exercise during the growing stage will have the effect of encouraging size of body beyond that which the undeveloped legs are capable of carrying. Confinement is necessary in fattening cockerels, but it is most undesirable in the case of those it is intended to breed from. Not only does it have the effect of overforcing the birds—a common cause of leg-weakness—but also results in falling-over combs as well. In the building-up or maintenance of a heavy-laying strain stamina in the male is of supreme importance. One cannot suggest a better way of promoting this than by giving the growing bird a good range under the most natural conditions possible. Naturally this should go hand in hand with good feeding and housing, and general efficient management.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

AUTUMN MANAGEMENT.

IN case all surplus honey has not been removed by the time these notes appear beekeepers would be well advised to use bee-escapes, as indicated in last month's notes. There is a grave risk of starting robbing unless extreme care is exercised in removing honey so late in the season. However, the use of bee-escapes will, with ordinary care, enable the beekeeper to complete his operations in comfort and without the interference of robber bees, which are particularly active at the close of the flow.

In some districts after the autumn rains a small flow of honey may be experienced, sufficient to meet the daily needs of the colony, with some to store for winter food. It is well, however, to make sure that the colonies have a sufficient supply of honey on hand to winter well; thus an estimate of stores should be made when the remainder of the surplus is taken. In most districts it is good practice to leave not less than 40 lb. of honey for each colony's requirements, while in some districts 60 lb. will be a safer estimate. It must be remembered that it is in autumn the beekeeper is laying the foundation for the next season's crop; therefore he should concentrate in wintering his bees well. The three main factors to be observed are strong colonies, abundance of stores, and queen-right hives.

As the season advances supers not fully occupied by the bees should be removed and stored away.

UNITING COLONIES.

As advised last month, all weak and queenless hives should be united. The golden rule of modern beekeeping is to keep all colonies strong, and this applies specially to the autumn months, when weak colonies are in danger of being robbed. If by any chance late swarming and weak colonies from defective queens have to be dealt with the procedure recommended is as follows: After taking the roof and mat from a queen-right hive, place a sheet of newspaper immediately over the top of the frames, and carefully place the queenless colony on top. Little smoke will be required if the colony is gently handled. Weak colonies should be similarly treated. There is no need to remove one of the queens, as the bees will decide which they will keep.

ROBBING.

Robbing is the result of carelessness, and once it has started is exceedingly hard to check. Do not expose honey, sugar-syrup, or anything that the bees can rob. See that the honey-house is bee-proof, and that all combs and vessels containing honey are removed to a place of safety. Contract all hive-entrances, and especially guard against leaving hives open in a way that they can be attacked by robbers. All operations must be carried out quickly. If robbing has started it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the

entrance and pile wet grass in front of the hive. This will usually cure mild cases of robbing, but where a colony has been over-powered by the robbers it should be closed altogether.

CARE OF EXTRACTING-COMBS.

If proper care is not to be exercised in storing the extracting-combs when removed to the honey-house, it is far better that they should be stored in the hives. If the latter plan is adopted the mats must be placed on top of the brood-chamber, and the supers tiered above the mats. Unless the apiary is well sheltered, however, the hives must be weighted, as the winter gales will easily upset them when only empty combs are stored inside. It is far better to remove the combs if it can possibly be done, and thereby obviate the labour of lifting the supers if it becomes necessary to examine the brood-chamber. But in this case the combs must be properly housed to secure them from destruction by mice and wax-moths. It is not uncommon to find tiers of extracting-combs destroyed as the result of carelessness. Mice are especially destructive, and the damage they will do in a short period is such as to render the greatest trouble worth while in preventing them from gaining access to the combs. The price of foundation now ruling is making it far more costly to produce combs, and if large numbers have to be annually produced the renewals become a severe tax on the season's profits.

During extracting many combs may become damaged, but the damage can be repaired by the bees when the combs are returned to the hives. As a rule, however, mice destroy the combs beyond repair, and no effort on the part of the bees can restore them to their original form. It is during the working-season that the bee-keeper realizes the value of combs in securing a crop. A shortage of combs during the flow will often prevent the bees being kept in working-trim, and the production of honey will be greatly restricted. Mice destroy the combs to gain access to the pollen, and render them foul and offensive to the bees.

In the absence of a mouse-proof room the combs can be stacked in supers tiered one above another. Be sure that there are no holes or cracks in the supers through which the mice can obtain an entrance. Place a queen-excluder at the bottom of the tier and another on the top. Queen-excluders, if used as described, are a complete success in preventing mice from destroying the combs during the off-season. Should the wax-moth be detected the combs must be fumigated. Bisulphide of carbon is generally used for destroying insect-life, but it should be used with great caution, as it is highly inflammable. It is far better, when storing the combs at the end of the season, to place a few moth-balls among them. This will be sufficient to prevent the attack of the moths.

CARE OF EQUIPMENT.

As soon as the honey has been disposed of, thoroughly clean all utensils used in handling the crop. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c. Wash carefully

with boiling water, and dry thoroughly to prevent rusting. The high cost of equipment should impel the beekeeper to take great care in storing his plant during the off season. It is advantageous to use loose washing-covers of close texture to cover the tanks and extractor. The covers will help to keep the utensils free from dust that is likely to accumulate during the winter. See that all metal parts likely to rust are given a good coating of oil. In season or out of season the watchword of the beekeeper in the extracting-house should be cleanliness.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

GREEN-MANURING.

In the past the usual method at this season following the harvesting of a crop was, under some circumstances, to plough in a heavy dressing of stable manure by way of preparing the land for the next crop, and with cheap supplies this was a quick and efficient method of reconditioning land. With the ever-increasing use made of motor vehicles and traction in place of the horse, that supply is now seldom available, and while chemical fertilizers to some extent supply the need, they do not afford the humus and fibre that were supplied to the land by stable manure. These valuable ingredients are now obtained by sowing the land to be treated with a green cover-crop, and, when mature, ploughing it in and allowing it to decay:—a slow method which in the case of valuable land is a serious cost, as the time could otherwise be devoted to growing a marketable crop. For this reason many growers are inclined to starve the land for want of these supplies.

Experience will doubtless improve our methods in this direction, but meanwhile it is necessary to see that each area has reasonable attention of this kind periodically. By selecting cover-crops of a hardy nature they may be grown during the winter, when the land can best be spared from growing crops that are directly marketable. At this season, as soon as a market crop is harvested, disk or harrow down the land and sow a hardy green crop. The fertilizers in the ground will soon assist it to make a strong growth, which will keep the land clean, and mature in time to be turned in and decay before the spring planting. With the proper use of lime dressings this method can be relied upon to greatly assist in keeping the soil in good order.

THE VEGETABLE GARDEN.

A sowing of the large mild white Italian onion made now should be ready for harvesting in spring and early summer, when such onions are in great demand for salads. Warm, sheltered slopes where the soil is good may be sown down in dwarf green peas for a first early crop. Seed-beds may be made and sown with main-crop cabbage, cauliflower, and cabbage lettuce, the intention being to allow these plants to stand over for planting out in early spring. For this purpose sow rather thinly. Cauliflower and cabbage for early spring cutting should now be planted out from seed-beds into a piece of good

well-drained land. Complete earthing up the celery crop. Cut down the asparagus growth level with the ground as soon as it ripens and before the seed falls.

Potatoes, onions, pumpkins, &c., should be harvested as they mature, the keeping-qualities largely depending on how this is done. Pumpkins are best cut and allowed to remain for a while as they grew before gathering them; they should then be stored in a dry, airy place.

TOMATO GLASSHOUSES.

Tomato glasshouses will yield a good crop all the easier next season if they are well cleaned up now as required. Where insect or fungus troubles have been epidemic during the season, or have shown a tendency to become so, the present time affords the best opportunity of dealing with it. In such cases clean up the house and land well, and sow down the latter with a suitable green cover-crop, leaving ample ventilation on.

SMALL-FRUITS.

The preparation of land intended for strawberries should now be completed, and delivery obtained of the plants as soon as they are available. When they arrive, open up the bundles and air them. Trim up the roots and tops, and set out the plants as soon as the weather and the condition of the ground permit. This operation is facilitated if a fine, even, firm surface is first obtained. It is important to plant only varieties proved suitable to the locality, and to obtain the plants from a supplier with a reputation for careful selection. Experiments with new varieties are important, but they should first be tried on a small scale only.

Land to be planted out in bush fruits should now receive attention. Most of these plants have fibrous roots near the surface, which preclude deep cultivation after planting. For this reason deep and thorough preparation is necessary now. Place the order for plants without delay; supplies of this kind are usually short. Obtain delivery as soon as the plants are ready for lifting, and heel them in carefully; they will then be ready for planting out when required.

WALNUTS.

This valuable crop is worth careful attention. Too often the local sample compares badly with the imported nuts, although their intrinsic value is appreciated by the consumer. With a little more attention in harvesting, the local nuts might obtain a decided preference on the market. Gather the nuts as soon as there is a fair picking on the ground, and thus avoid stained shells. It is of some assistance to shake the branches with a long boathook-like implement. Sweet, well-flavoured kernels are obtained by thorough curing. For this purpose the nuts may be spread on shallow trays and thoroughly dried, going through them occasionally and turning them over. Avoid drying them too quickly in a hot sun, or nuts that are poorly sealed will open. Afterwards shake them in wire riddles of a suitable size to dispose of small nuts and litter, and finally pick them over, removing broken and blighted nuts, also those with husks adhering. They have then only to be bagged up ready for marketing.

—W. C. Hyde, *Horticulturist*, Wellington.

REVIEW.

"THE VEGETATION OF NEW ZEALAND."

Die Vegetation der Erde: XIV, The Vegetation of New Zealand.

By L. Cockayne, Ph.D., F.R.S., F.N.Z.Inst. XXVI + 456 pages; 107 figures on 87 plates, and three maps. Second edition, entirely rewritten, thoroughly revised, and enlarged. Wilhelm Engelmann, Leipzig, 1928. 42s., cloth-bound 45s.

"It is hardly possible to conceive a property or stores manager carrying on the management of a large estate or general store and yet being unaware of the stock at his disposal, the extent of his supplies or their nature. And yet this is, in the main, the position of the British Empire, its tropical colonies and protectorates in general, and even, to a certain extent, its great Dominions, so far as one of its greatest assets—natural vegetation—is concerned. No inventory of the vegetational assets of the Empire has been attempted, nor, so far as is known, is any officially contemplated." So write Professor Tansley and Dr. Chipp in their preface to "Aims and Methods in the Study of Vegetation" (1920). To remedy this state of affairs a "British Empire Vegetation Committee" has recently been set up. To the thoughtful New-Zealander, living in a land greatly endowed by nature, this committee should appeal as deserving every support. But New Zealand has not waited for this committee to function; indeed, in this "stock-taking" New Zealand has lead the way and serves as a model to other portions of the Empire.

Botanically considered, New Zealand is a *miutum in parvo*. With its wide range of latitude, its diversified coast-line, its great mountain-chains, its volcanic areas, its glacial lakes, its wide river-beds, its rainfall ranging from under 20 in per annum to over 100 in., it offers multitudinous growing-places for plants of varied forms and demands. We have the mangrove communities of northern estuaries, the subtropical rain-forests of the north, the subantarctic rain-forests of the south, the grasslands and deserts of the Volcanic Plateau, the great tussock plains of Canterbury, the rich subalpine flora and vegetation of north-western Nelson and the Southern Alps, swamps, bogs, coastal dunes and cliffs, rock-faces of diverse aspect and contour, the magnesian soil of the mineral belt, and so on almost endlessly. Then there are the differing elements of the flora—Malayan, Polynesian, Australian, Subantarctic, to name some—superimposed upon the palæozelandic element of the long-distant past. Then there is the long isolation of the land from other land masses, and its romantic and chequered geological career. The vegetation, as a result, presents a complicated picture, to match which bits would have to be taken from many countries. To elucidate all this, to marshal the facts, to analyse the vegetation and flora into their component parts and to reduce all to order, so that he who runs may read, would seem almost a superhuman task. Yet it has been done, and New Zealand should be proud of those who have accomplished the work.

We remember specially the pioneer and fundamental labours of the great Hooker in providing the correct names of the plants with which we have to deal, and the work of those who continued on the lines laid down—notably, Kirk, Petrie, and Cheeseman. Only with this work as a basis could the vegetation itself be properly studied. In this regard we owe our knowledge almost entirely to the genius, energy, and perseverance of one man—Leonard Cockayne. The ecological work of this eminent botanist—commencing in 1887 and still being actively prosecuted—is crowned by the publication of the volume now under review. It will be hailed by ecological botanists the world over not merely as a complete work of reference on its subject, but as a model of what is required for all countries. Nor has Dr. Cockayne's influence on taxonomic botany—the study of the systematic status of the individual plants and their grouping into different classes—been any the less profound. Indeed, the taxonomic procedure of the whole botanical world is being vastly influenced by his discovery of the part played by hybridism in the New Zealand flora, and its bearing on the question

of "species" and their evolution. Evidence of this will be found throughout the present volume, and will be closely studied by all concerned with such problems.

To state that this second edition is really a new book is no exaggeration. In 1904 Dr. Cockayne was invited by Professor A. Engler to contribute a volume on the plant-geography of New Zealand to the great series being published by Wilhelm Engelmann under the title, "Die Vegetation der Erde." With characteristic enthusiasm Dr. Cockayne flung himself into the task, and the work was published in 1921. It at once achieved its mark. This first edition was reviewed in this *Journal* for August, 1922 (p. 125). It is there said, "Dr. Cockayne is not primarily concerned in his book with the economic aspects of plant ecology, but no serious student of any of the branches of agricultural science can read the work without feeling that a new power of vision has been acquired by him—that the different plant communities with which he has to deal—pasture, field-crop, or forest—are subject to laws of infinite variety and subtlety, and that even the partial elucidation of some of these laws will confer on agriculture gifts as yet undreamed of."

This is still more true of the new edition, where the economic applications are often directly suggested, and the book must be read as a whole for its lessons to be thoroughly learned. It is indeed a new work, more logically arranged, with a more philosophical outlook, and with still more adequate treatment of detail. One may mention, as examples, the fuller treatment of problems of succession—the changes occurring in the nature of the vegetation on a particular area from period to period; the use of particular cases to elucidate phenomena of general occurrence, the new treatment of the individuals concerned and their status, especially the consideration given to hybridism and to epharmony—the response of the individual to diverse conditions of its different growing-places. To quote from the preface: "That the making of a book so greatly changed was possible is due in large measure to my having botanically re-explored much of the Region, thanks especially to the carrying-out of plant-ecological studies at all altitudes of the tussock-grassland and forest areas for the Department of Agriculture and the State Forest Service respectively." Generous acknowledgment is made of the assistance of other workers—those workers themselves inspired by the example and whole-hearted encouragement and support of their master.

The book is divided into five parts. Part I gives in lucid manner those preliminaries essential to the proper understanding of what follows, and should be closely scanned by the student. We have the necessary definitions of the terms used for both vegetational and floristic units. The history of botanical investigation records all work of moment accomplished up to the date of publication, and is followed by a full and valuable bibliography. Concise and illuminating descriptions are given of the physiographical features of the region, its soil-types, and its climate. Part II gives a remarkably full picture of the primitive vegetation and semi-primitive vegetation. This is based on definite and careful notes taken in the field over many years, and the part will remain a standard treatise on its subject. As the years go by and the face of New Zealand is more and more altered, so the more will this record be enhanced in value—a permanent memorial of what our land was before the march of civilization entered upon its destroying course. It is true to say that the picture given is so complete and accurate that there remain, in large measure, only minor details for younger students to fill in before it is too late. Throughout are given statistical summaries, the result of laborious work so punctiliously performed that it is indeed difficult to catch our author tripping. The part is divided into three sections in which we study the vegetation of the sea-coast (Mr. W. R. B. Oliver, Director of the Dominion Museum, contributes a brief account of the seaweed communities), of the lowlands and lower hills, and finally of the high mountain areas. A fourth section deals with the outlying islands—the Kermadecs, Chatham, and subantarctic islands. In each section, before the discussion of the actual plant-communities, we are given a mental picture of the leading species, their growth-habits, their seasonal changes, their epharmonic modifications, and other biological matters.

To most readers of this *Journal* the chapters on the grasslands will have an especial appeal and utility. The great types of tussock-grassland—the low tussock-grassland dominated by *Festuca novæ-zelandiæ* and *Poa caspitosa*, and the tall tussock-grassland dominated by *Danthonia Raoulii*—are discussed in considerable detail, and matters fundamental to their management may be gleaned.

The reader will then be in a position to profit more fully by the practical papers published by the author in this *Journal* under the title "An Economic Investigation of the Montane Tussock-grassland of New Zealand" (1919 onwards).

Part III, dealing with the effect of settlement upon the plant-covering of New Zealand, should be read in detail by all who are "on the land." It may also be commended to the study of all legislators or prospective legislators. It is in following up the work dealt with in this part that the new generations of botanists will find their great ecological task. Here to hand is a common-sense and workable preliminary classification that will serve as a basis for further study. We have (1) the "modified communities," which are altered to a greater or lesser extent from their primitive condition; (2) the "indigenous-induced" communities, composed of or at least dominated by indigenous species, but not existing in primitive New Zealand (danthonia grasslands is an example of great importance to the farmers); (3) the "exotic-induced" communities, composed of or dominated by species of exotic origin, *e.g.*, blackberry thickets; (4) the "artificial" communities created directly by man, *e.g.*, rye-grass pastures. Much of practical moment yet remains to be discovered, and future changes will have to be studied and recorded. A true realization of the status and relative importance of our "weed" flora is essential to progress. Consider, for example, the statement, "Thus, in the great tussock-grassland formation, nearly all the exotic edible plants possess palatability to a far higher degree than do the indigenous ones." There is a clear discussion of the effects of burning the tussock, a question still much debated. A brief account of the artificial communities (*e.g.*, the replacement of fern-heath by artificial grassland), from the pen of Mr. A. H. Cockayne, Director of the Fields Division of the Department of Agriculture, and a chapter on the agriculture and horticulture of the Dominion, add to the value of this part.

Part IV, giving the distribution and composition of the flora, while of more technical interest, contains under each botanical district a statement of the agricultural and pastoral practice there. It is seen that the division into natural districts (six in North Island, eight in South Island) according to the flora and vegetation agrees very well with the division according to farm practice. A chapter on the families, genera, and elements of the flora is of considerable phytogeographical interest. We find that the ferns and flowering-plants total 1,843 species belonging to 109 families and 383 genera, and that 78.6 per cent. of these are endemics or purely New Zealand species. The great importance of the recognition of the prevalence of wild hybrids is fully brought out, as are the relationships of the flora with those of Australia, the Subantarctic Region, Malaya, and Polynesia. The conclusion is drawn, "The flora of New Zealand, notwithstanding its strong endemism, possesses two very distinct elements not floristic only, but ecological." The first is a combination of the palæozelandic and subantarctic elements—a temperate element; and the second is made up of the descendants of an ancient palæotropical stock.

Part V deals very briefly with the history of the flora. The author considers that "the origin and subsequent history of the New Zealand flora is, in great measure, a matter of speculation merely." On the "burning" question of ancient land-connections the author is in favour, on the whole, of the belief in a land "bridge" at some time antecedent to the advent of mammals on the connected area. The problematical history of the flora following on the changes of land surface during the different geological ages, concludes the chapter.

The illustrations, which are excellent and representative of the chief plant communities discussed, are grouped together after a complete index of plant-names. The two clear maps showing the botanical districts and many of the chief localities referred to add greatly to the utility of the book. Printed in large type well differentiated on heavy glazed paper, the work shows a great improvement in format on the first edition, and reflects great credit on the enterprising publishers, who have served science so well in entering upon this series of studies of the world's vegetation.

The book has been seen through the press by Professor L. Diels, Director of the great Botanic Garden and Museum of Berlin. He has discharged his voluntary and onerous duties brilliantly, letting slip few errors of any kind. That he should have undertaken the work is sufficient proof of the esteem in which Dr. Cockayne is held abroad, and of the high place he holds in the botanical world.

WEATHER RECORDS : FEBRUARY, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

FEBRUARY was a very dry month, the far southern portions of Otago and Southland being the only part of the Dominion to receive more than the average rainfall. Numbers of places in Canterbury recorded no rain at all. South of Dunedin rain fell on a fair number of days, but elsewhere almost the whole of the month's precipitation occurred during the first five days, and most of it on the 1st and 2nd.

Meteorologically the month was a quiet one. There was a comparative absence of wind, the prevailing direction being south-westerly. The thundery conditions of the previous months were not maintained. Thunderstorms were reported, however, from a number of stations on the 3rd, and a hailstorm in the Oamaru district did much damage to vineries at Kakanui. Temperatures and sunshine were above normal.

The continued dry weather caused pastures to become very parched during the latter half of the month, and milk-yields have declined. Otherwise stock are reported to be in good condition, and the dry spell was advantageous to the extent that it checked the rank growth of feed produced by the heavy rains of the earlier months. Reports indicate fair or good yields from crops of all sorts, and harvesting and haymaking have been carried out under favourable conditions.

The strongly developed monsoonal conditions over Australia which characterized January were again in evidence in February. Pressures were low for most of the time in northern Australia. These low pressures were counterbalanced by a stationary high-pressure system over the Tasman Sea, which was responsible for the prevalence of south-westerly winds over New Zealand and the dry weather which prevailed between the 6th and the 23rd. The area of low pressure extended eastward from tropical Australia during the third week of February, and a cyclone developed between Fiji and the New Hebrides. The centre passed close to the Kermadec Islands on the 21st, but the effect on New Zealand weather was slight.

The rain during the first days of the month was due to a deep depression of the southern or westerly type, which was centred in the South Tasman Sea on the 1st. This was followed by a series of secondaries, of which the last crossed the Dominion on the 5th. There were northerly gales in Cook Strait on the 2nd, and southerly gales round the southern extremity of the South Island between the 5th and the 7th.

From the 23rd to the end of the month another series of depressions of the westerly type affected the South Island, but the rain was confined practically to the west coast and far southern districts.

—Edward Kidson, Director of Meteorological Services,
Wellington, 6th March, 1929.

RAINFALL FOR FEBRUARY, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average February Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitaia	0.34	5	0.12	2.95
2	Russell	0.21	3	0.10	3.20
3	Whangarei	0.20	1	0.20	4.46
4	Auckland	0.61	6	0.39	3.06
5	Hamilton	0.82	4	0.48	2.96
6	Kawhia	2.05	7	1.66	2.66
7	New Plymouth	1.06	6	0.54	4.00
8	Riversdale, Inglewood	1.61	5	0.85	6.30
9	Whangamomona	0.80	2	0.40	4.23
10	Eltham	1.06	5	0.98	3.37
11	Tairua	0.44	2	0.40	4.10
12	Tauranga	0.84	3	0.77	3.58

RAINFALL FOR FEBRUARY—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
<i>North Island—continued.</i>					
		Inches.		Inches.	Inches.
13	Maraehako Station, Opotiki	1.04	1	1.04	3.48
14	Gisborne	0.37	4	0.20	3.63
15	Taupo	0.84	2	0.75	2.82
16	Napier	0.20	1	0.20	2.92
17	Maraekakaho Station, Hastings	0.41	3	0.39	2.52
18	Taihape	0.68	5	0.23	2.52
19	Masterton	0.28	4	0.16	2.70
20	Patea	0.94	5	0.60	2.51
21	Wanganui	0.76	2	0.65	2.52
22	Foxton	0.74	3	0.68	2.06
23	Wellington (Karori) ..	1.01	5	0.39	3.07
<i>South Island.</i>					
24	Westport	2.76	9	1.45	4.37
25	Greymouth	5.38	15	1.14	5.99
26	Hokitika	4.44	15	1.80	7.31
27	Ross	5.43	7	2.88	8.45
28	Arthur's Pass	7.09	7	3.90	10.17
29	Okuru, Westland	5.10	5	2.40	7.92
30	Collingwood	2.24	4	1.90	5.63
31	Nelson	0.72	3	0.43	2.77
32	Spring Creek, Blenheim	0.37	3	0.26	2.25
33	Tophouse	1.30	5	0.63	4.39
34	Hanmer Springs	0.32	4	0.15	3.04
35	Highfield, Waiau	0.56	2	0.40	2.54
36	Gore Bay	0.55	3	0.25	2.93
37	Christchurch	0.10	4	0.04	1.77
38	Timaru	0.20	4	0.10	1.82
39	Lambrook Station, Fairlie ..	0.10	2	0.06	1.89
40	Benmore Station, Clearburn	0.46	3	0.34	1.36
41	Oamaru	0.61	4	0.26	1.68
42	Queenstown	1.19	4	0.67	1.98
43	Clyde	0.26	4	0.11	0.99
44	Dunedin	1.43	11	0.86	2.69
45	Wendon	1.18	7	0.40	2.03
46	Gore	3.34	13	0.90	2.65
47	Invercargill	4.40	19	1.75	2.85
48	Puysegur Point	5.15	18	0.96	4.96
49	Half-moon Bay	5.39	17	1.54	4.13

MYCOLOGICAL INVESTIGATIONS ABROAD.

NEW ZEALAND will be represented at the Second Imperial Mycological Conference, to be held in London next September, by Dr. G. H. Cunningham, Government Mycologist, Department of Agriculture, who has been in charge of the Plant Research Station at Palmerston North during the past year. Dr. Cunningham is leaving next month for the United States and Canada, where he will spend some three months in making investigations and personal contacts in his branch of science. He will then proceed to Europe for the Conference, and to undertake further important investigational and consultative work, both in Britain and on the Continent, this part of the tour also comprising a period of about three months. The return to New Zealand will be made via Suez in November next. The first Imperial Mycological Conference, held in London in 1924, was also attended for the New Zealand Government by Dr. Cunningham, then Mycologist at the Biological Laboratory of the Department of Agriculture, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MIXING OF LIME WITH FERTILIZERS.

"LIMESTONE," Rangiora :—

I should be glad to know whether if I mixed carbonate of lime with superphosphate the carbonate would act with the super on the crop for which it is sown, or would I have to mix burnt ground lime with the super to get results with the super. Also would carbonate of lime have a bad effect in liberating the nitrogen if mixed with blood-and-bone fertilizer ?

The Fields Division :—

As a general rule, a mixture of carbonate of lime and superphosphate will give good results on the crop for which it is sown. From the farmer's point of view the use of this mixture is quite a good practice, especially in connection with the sowing of turnips or other small seeds. Superphosphate should not be mixed with burnt lime. Carbonate of lime may be mixed with blood-and-bone fertilizer, but the mixture should be kept in a dry place.

PRAIRIE-GRASS AND CHICORY.

"ABC," Otane :—

I would be obliged for any information about prairie-grass and chicory, as to their suitability to a peat swamp which is wet in winter and dry in summer ; also whether chicory is easily eradicated.

The Fields Division :—

Prairie-grass likes nice warm land, and cannot be recommended for a swamp wet in winter. The same may be said of chicory (*Cichorium intyhus*), which is usually grown on dry hard land. Chicory would be easily killed by grubbing, but as stock eat it well it is not likely to become a pest.

FERTILIZER IMPORTATIONS: DECEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 31st December, 1928 :—

Sulphate of ammonia : United Kingdom, 480 tons ; Australia, 100 tons ; Germany, 7 tons ; United States, 155 tons. *Nitrate of soda* : Chile, 500 tons. *Basic slag* : United Kingdom, 190 tons ; Belgium, 1,545 tons ; Germany, 15 tons. *Bonedust* : India, 25 tons. *Rock phosphate and guano* : United Kingdom, 5 tons ; New Caledonia, 1,523 tons ; Nauru Island, 41,500 tons ; Makatea Island, 4,534 tons. *Phosphates (other)* : United Kingdom, 260 tons ; Belgium, 781 tons ; France, 75 tons ; Egypt, 4,250 tons ; Morocco, 3,087 tons. *Superphosphate* : Belgium, 10 tons. *Kainit* : France, 85 tons ; Germany, 25 tons. *Muriate of potash* : Germany, 14 tons. *Sulphate of potash* : France, 315 tons ; Germany, 311 tons. *Potash (other)* : France, 1,935 tons ; Germany, 1,794 tons. *Sulphate of iron* : United Kingdom, 39 tons ; Australia, 1 ton ; Germany, 1 ton. *Other manures* : United Kingdom, 112 tons ; Belgium, 150 tons ; Germany, 19 tons.

Massey Agricultural College Council.—Mr. Arthur Morton, of Taranaki, has been appointed a member of this Council.

STATISTICS OF IRRIGATED LANDS.

FOLLOWING are particulars relative to irrigated lands in New Zealand for the years 1926-27 and 1927-28:—

Utilization of Irrigated Lands.					Area irrigated.	
					1926-27.	1927-28.
					Acres.	Acres.
Orchards .. .. .	..	..	..	..	2,027	2,244
Green fodder and root crops .. .. .	..	..	..	..	2,273	3,099
Pasture .. .. .	..	..	..	..	49,942	50,201
Lucerne .. .. .	..	..	..	..	2,165	1,290
Oats .. .. .	..	..	..	..	428	316
Wheat .. .. .	..	..	..	..	65	60
Barley .. .. .	..	..	..	..	58	16
Market gardens .. .. .	..	..	..	..	29	6
Other crops .. .. .	..	..	..	..	46	8
Totals .. .. .	..	..	..	..	57,033	57,240

—Census and Statistics Office.

AREAS IN ORCHARDS, MARKET GARDENS, AND NURSERIES.

					1926-27.	1927-28.
					Acres.	Acres.
Market gardens (excluding potatoes of $\frac{1}{4}$ acre and over)					5,102	5,655
Nurseries and seed-gardens—						
Forest-tree seedlings .. .. .	..	..	..	..	198	193
Other young trees and nursery stock, &c. ..	..	..	..	..	266	296
Vineyards .. .. .	..	..	..	..	309	285
Commercial orchards—						
Bearing .. .. .	..	..	..	..	19,036	18,283
Not bearing .. .. .	..	..	..	..	1,245	1,581
Private orchards .. .. .	..	..	..	..	5,096	5,123

"Commercial" orchards are defined for statistical purposes as "those producing fruit for sale to the value of £50 and upwards annually, or, if not in full bearing, or if for any reason the crop has been a failure, that are calculated to produce fruit for sale to that value when in full bearing or in normal seasons, as the case may be." This definition is one used for statistical purposes only, and has no reference to commercial-orchard districts under the Fireblight Act, 1922, or to orchards under the Orchard-tax Act, 1927. Private orchards, for statistical purposes, consist chiefly of small areas the produce of which is consumed principally on the holding, or, if sold, does not aggregate an annual value of £50.

For the 1927-28 collection of statistics special cards were sent out to orchardists, and this revealed a number of errors, particularly in classifying as "commercial" certain orchards which were incapable of producing sufficient revenue to be classed as commercial orchards.

—Census and Statistics Office.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 13th December, 1928, to 7th March, 1929, include the following of agricultural interest :—

No. 55740: Milking-machine; E. J. Ellery and F. A. Stempa, Invercargill.
 No. 58155: Fence standard; Corkscrew Steel Fences, Ltd., Sydney, N.S.W.
 No. 58479: Gate-hinge; A. C. Honey, Greymouth. No. 61295: Cure of foot-rot; W. J. Bowes, Christchurch. No. 61481: Sheep-shearing machine; J. Davidson, Sydney, N.S.W. No. 59389: Plough-share; A. M. Eaden; Ashburton.
 No. 59555: Bleaching flax; M. H. Wynyard, Orehunga. No. 59742: Milking-machine pulsator; G. J. Heaven, Masterton. No. 61108: Potato-bagger; A. B. Hayman, Willowbridge. No. 61322: Chain-harrow link; D. McL. Wallace, Ltd., Te Aroha. No. 61586: Cheese-press; J. B. MacEwan and Co., Ltd., Wellington.
 No. 61603: Press for baling wool; N. P. Cash, South Yarra, Victoria. No. 61642: Distributing seed and fertilizer; H. J. Sampson and H. D. Sampson, Ngaruahia. No. 61712: Apparatus for the production of butter, J. Siedel, Cammin, Germany. No. 58412: Manure broadcast distributor; J. Rollo, G. S. Millar, and C. D. Chant, New Plymouth. No. 61765: Cleaning fly-infested animals; L. R. L. Bourgault du Coudray, Mauritius. No. 61859: Flax-dressing machine; N. C. Grigg, Drysdale, Victoria. No. 59064: Automatic scutching-machine; M. H. Wynyard, Orehunga. No. 60018: Cream-separator driving means; L. W. Hunwick, Wanganui. No. 60171: Teat-cup; W. E. Hunter, Whangarei. No. 60248: Teat-cup support; C. Swanson, New Plymouth. No. 60339: Manufacture of butter; E. Perks, Auckland. No. 60563: Treatment of mammitis; J. H. Godyer, Murray Bridge, Victoria, and A. J. Cooke, Glenelg, South Australia.
 No. 61797: Seed-separating; Warren-Teed Seed Co., Chicago, U.S.A. No. 61882: Seed-separating process; Warren-Teed Seed Co., Chicago, U.S.A. No. 61890: Egg carton construction; E. N. Hale, Buffalo, U.S.A. No. 61954: Sheep-shearing machine comb-plate; J. Davidson, Sydney, N.S.W. No. 61966: Cattle-fodder; J. E. Nyrop, Horsholm, Denmark. No. 59565: Plough-lift; J. C. Edie, Morton Mains. No. 59809: Treatment of mammitis; J. B. Bennett, Waitakaruru. No. 60088: Packing live-stock for transport; E. F. Mitchell, Melbourne, Victoria. No. 60092: Treatment of mammitis; E. R. Cotton, Matamata. No. 61459: Manure-distributor; J. E. Sedcole, Masterton. No. 61731: Spool for barbed wire; Pearson, Knowles, and Rylands Brothers (N.Z.), Ltd., Auckland. No. 61759: Milking-machine releaser; W. Drinkall, Te Aroha. No. 61832: Distributor for manure; J. G. Clark, Ohura.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates for the remainder of the season have been notified by agricultural and pastoral associations :—

Hawke's Bay A. and P. Society (Autumn Show): Temoana, 20th March.
 Mayfield A. and P. Association: Mayfield, 23rd March.
 Methven A. and P. Association: Methven, 27th March.
 Oxford A. and P. Association: Oxford, 4th April.
 Flaxbourne A. and P. Association: Ward, 18th April.

Bill Moose Linseed.—This variety of linseed, although a high yielder, often suffers from the fact that the straw is short and the crop difficult to harvest. A number of selections have been made by the Department of Agriculture indicating that the length of straw is quite variable, and some tall-strawed forms are being kept for further trial as to their yield.

The New Zealand Journal of Agriculture.

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No. 4

WHEAT-MANURING EXPERIMENTS IN CANTERBURY.

SUMMARY OF SIX SEASONS' RESEARCH AND RECOMMENDATIONS TO FARMERS.

Fields Division.

Introduction.

EXPERIMENTS on the manuring of wheat in Canterbury have been in progress for the past six years. Although much still remains to be done before all the manurial problems connected with the wheat crop have been solved, enough has been accomplished to warrant the publication of a general summary of the whole of the experiments up to date.

The results obtained from year to year have already had a great effect on manurial practice in the wheat-growing areas, and the great value of sustained work in this direction is well exemplified by the Department of Agriculture being now in a position to give definite and reliable advice, based not on surmise or opinion but on accurate experimental experience carried out under practical farming conditions.

The successful prosecution of this work is largely due to the untiring efforts of Mr. A. W. Hudson, Crop Experimentalist, who is wholly responsible for the designing of the experimental work and for the very excellent technique now generally adopted by the Department. This technique, from the standpoint of accuracy, leaves little to be desired, and at the same time fits in admirably with the requirements of the farmer.

In this connection one cannot refrain from expressing appreciation of the generous help afforded the Fields Division by co-operating farmers, who have placed land and facilities at our disposal, and have created a bond of sympathetic interest which has made the work a pleasure to all the staff.

The very large amount of field work involved has been admirably carried out by the field staff, of whom Messrs. A. Y. Montgomery, R. A. Calder, E. M. Bates, A. G. Elliott, and W. Stafford must be especially mentioned. They have all spent much time outside ordinary

hours in assuring the success of the work, and have at least the satisfaction of knowing that they are contributing in no small degree to the general adoption of methods that will tend to the immediate increase of our wheat yields, and that on a very profitable basis.

—A. H. Cockayne, *Director of the Fields Division.*

Initiation and Development of the Work.

The wheat-manuring experiments were commenced in 1923 by a group at Christchurch known as the Soils Improvement Committee; set up at the instigation of Mr. G. H. Holford. The committee consisted of representatives of the Department of Agriculture, Canterbury Agricultural College, and several firms and others interested in the development of scientific agriculture. In the first season the firms represented contributed manures for the trials. Subsequently the work here described was taken over entirely by the Department of Agriculture, and with modification of equipment and technique has developed in the manner to be indicated.

From two experiments in the 1923-24 season the number increased to twenty-six actual harvested trials in 1928-29. Eight others were laid down in the latter season, but on account of weather and other conditions could not be harvested. In addition, seven comprehensive trials to test the effect of various disease treatments on yield were carried out in 1928-29. For four seasons the work had to be confined to a restricted area of wheatgrowing land in the vicinity of Christchurch. Better facilities for the sowing and threshing of crops has enabled the work to be extended to most of the principal wheatgrowing districts in Canterbury and North Otago, and an extension to Marlborough in the 1929-30 season is anticipated. Figs. 1 and 4 indicate the nature of the equipment now in use.

The methods of conducting trials have been described in the *Journal* from time to time, and a list of references is given at the end of this article which will enable interested readers to get fairly full details not only of methods but also of the yields of individual experiments.

Problems under Investigation and Necessity for their Modification as Work progressed.

The original programme of work provided for the determination of the relative merits of superphosphate and basic super, and for the comparison of each of these with a mixture of itself and a small amount of nitrogen in the form of dried blood. It soon became apparent that the difference between super and basic super was so slight as to necessitate a large amount of work in its determination. This work has been continued with results as will be indicated.

In the case of the mixture containing blood as a form of nitrogen, the inconclusive nature of results clearly pointed to the necessity for increasing the amount of blood. This was increased to 1 cwt. per acre and added to the basal dressing of 1 cwt. of phosphate (super or basic super). Also, in two experiments in the 1925-26 season nitrate of soda and sulphate of ammonia were used, as representing more efficient forms of nitrogen. The use of the 1 cwt. quantity of blood

was continued for two seasons, and results were still inconclusive in most cases, although the indications were that nitrogen used at the greater quantity was beneficial. This was definitely so where the soluble forms of nitrogen—nitrate of soda and sulphate of ammonia—were being used. In order to arrive at a definite conclusion as to whether or not nitrogen, *as an adjunct to phosphate*, was beneficial, it was evident that all consideration of the form of nitrogen must be dropped for the time being, and an effort made to decide the major problem, "Does the use of the most efficient form of nitrogen, used in a reasonable quantity, as an adjunct to phosphate, increase yield over that given by straight-out phosphate?" Nitrate of soda was selected as being in all probability the most efficient form of nitrogen under Canterbury conditions.

The results shown later indicate the advantage of this modification. The introduction of the trial of potash in conjunction with phosphate and phosphate plus nitrogen was made in the 1925-26 season. For two seasons $\frac{1}{2}$ cwt. of sulphate of potash was used. Depression in yield as a result of its use occurred in one or two cases, and an increase was obtained in two cases, in the seasons 1925-26 and 1926-27. Evidently, then, the potash question was in much the same position as that of nitrogen, and in the seasons 1927-28 and 1928-29 the quantity used was increased to 1 cwt. per acre.

In these last two seasons the main extension of the work to the principal wheatgrowing districts throughout Canterbury occurred, and standard types of experiments were adopted. Two other forms of phosphate—Ephos and Nauru—were also introduced, because experienced and observant farmers claimed certain advantages from these manures over the more readily available ones. The usual contention was that the slower-acting phosphates did not cause such a rank growth in the early part of the season and "carried the crop on" longer at ripening-time. These contentions are quite correct, but evidence from experiments has shown that they *do not* indicate increased yield or quality of sample—quite the contrary, in fact. These points will be enlarged on later.

Treatments used in 1927-28 and 1928-29 Experiments.

The manurial programme in the past two seasons was as follows:—

Type A Experiments.

- (1) No manure.
- (2) Superphosphate (44-46 per cent. tricalcic phosphate) .. 1 cwt.
- (3) Basic super (41-43 per cent. tricalcic phosphate) .. 1 cwt.
- (4) Ephos phosphate (guaranteed 54 per cent. tricalcic phosphate) 1 cwt.
- (5) Nauru phosphate (approximately 80 per cent. tricalcic phosphate) 1 cwt.

Type B Experiments.

- (1) Superphosphate 1 cwt.
- (2) Super 1 cwt., plus muriate of potash (51 per cent. K_2O) 1 cwt. 2 cwt.
- (3) Super 1 cwt., plus nitrate of soda (15.5 per cent. nitrogen) 1 cwt. 2 cwt.
- (4) Super 1 cwt., plus muriate of potash 1 cwt. and nitrate of soda 1 cwt. 3 cwt.

One each of these experiments was laid down on the same paddock on each farm under trial.

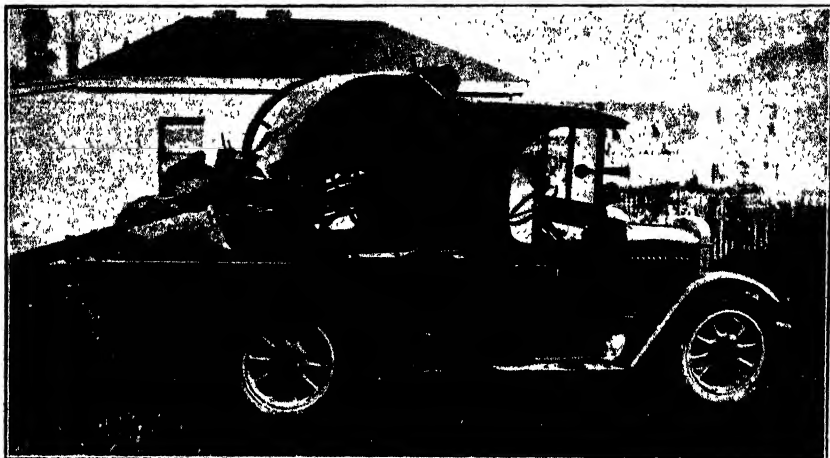


FIG. 1. SEVEN-COULTER DRILL USED FOR SOWING EXPERIMENTS, TRANSPORTED ON A MOTOR-LORRY

The advantages of having a special machine of this size are as follows: (1) The drill is easy to convey from farm to farm; (2) a high degree of accuracy in sowing manures can be attained; (3) the minimum of time is occupied in getting necessary adjustments for quantities of seed and manure (preliminary adjustments for manures are made before the machine leaves the Department's depot); (4) plots can be repeated a large number of times without the area occupied by an experiment being unduly large.



FIG. 2. PORTION OF A TYPICAL EXPERIMENT SOWN WITH THE DRILL SHOWN IN FIG. 1.

The pegs shown in the photo indicate the following treatments (left to right): (1) No manure; (2) basic super, 1 cwt.; (3) super, 1 cwt.; (4) Rphos, 1 cwt.; (5) Nauru, 1 cwt. Ten replications of this series constitute the experiment. A 14-in. space is left between outside rows of adjoining plots. Each experiment is so designed as to be sown in one day. Thus conditions at time of sowing are as uniform as it is possible to get them.

Increased Yields as a Result of using Superphosphate at 1 cwt. per Acre.

During the period of six years under review, thirty-three trials in which super has been compared with no-manure have been conducted. Of these, five have failed to give any significant increase, while the remaining twenty-eight have shown increases of from 1.2 to 13.8 bushels per acre. The average increase over the thirty-three trials has been 5.1 bushels per acre.

Valuing wheat at 5s. per bushel and super at 5s. per cwt. (not allowing for cost of cartage or application), it is evident that an increase of 1 bushel meets the cost of manure. The increase of just over 5 bushels shows a good profit of about £1 per acre, or about 400 per cent. on the outlay.

Superphosphate Response in Relation to Natural Yields of Fields under Experiment.

Further analysis of the thirty-three trials in which super is compared with no manure has been made in the above respect. The experiments have been divided into (a) those having yields on the unmanured plots (natural yields) of *less* than 40 bushels per acre, and (b) those having yields on the unmanured plots of *more* than 40 bushels per acre.

The average increase for super has been calculated in both cases, and the results are as follows :—

(a) Average super increase on fields with natural yields of *less* than 40 bushels per acre = 6 bushels per acre, with a range of from 1.2 to 13.8 bushels.

(b) Average super increase on fields with natural yields of *more* than 40 bushels per acre = 4.4 bushels, with a range of from 0 to 10.4 bushels.

The data are somewhat limited for such examination, but probably indicate the position fairly accurately. Further, they indicate that high-yielding land is quite capable of responding to a highly paying extent to the use of superphosphate. On the experiment having the highest natural yield of 68 bushels per acre super gave an increase of 7 bushels.

Superphosphate compared with Basic Super.

Twenty-nine of the above-mentioned trials had plots receiving basic super at the same rate per acre as the super. In no single case has basic super proved superior to super in increasing yields. In about a quarter of the trials super has established a significant superiority over basic super. In the remainder super was generally a little better than basic super, but significance could not be attached to the individual results. Statistical examination of the twenty-nine trials reveals the following :—

	Bushels per Acre.	
Increase of super over no manure	5.5
Increase of basic super over no manure	4.3
Difference in favour of super	1.2

The difference is significant. Therefore it can be concluded that 1 cwt. of super is generally a better phosphatic manure for wheat than basic super.

Further Analysis of Comparison between Super and Basic Super.

As in the case of the comparison between super and no-manure, the twenty-nine comparisons between super and basic super have been divided into two parts: (a) Those on fields with natural yields below 40 bushels per acre, and (b) those on fields with natural yields above 40 bushels, with the following results:—

(a) Average increase of super over basic super on thirteen experiments having natural yields below 40 bushels = 1.9 bushels per acre.

(b) Average increase of super over basic super on sixteen experiments having natural yield above 40 bushels = 0.7 bushel per acre.

Thus the contention that slower-acting phosphates are more readily available on good than on poor land would appear to apply in the case of wheat land, but at the same time these results indicate that the use of basic super in preference to super is not justified, even on the "stronger" wheat soils.

Super compared with Ephos and Nauru Phosphates.

In all, seventeen trials in which all three of these forms of phosphate were used have been conducted in the past two seasons. The yields from 1 cwt. of super have been superior to those from 1 cwt. of Ephos or 1 cwt. of Nauru in fifteen of the experiments. In two cases there was no response from any form of phosphate.

Taking the average increases over no-manure given by these three phosphates in the seventeen trials, a very appreciable and significant superiority of super is evident, as follows:—

	Bushels per Acre.
Increase of super over no manure .. .	5.6
Increase of Ephos over no manure .. .	2.0
Increase of Nauru over no manure .. .	1.5

The superphosphate yields thus show an average increase of 3.6 and 4.1 bushels per acre over those of Ephos and Nauru respectively.

Effect of adding Nitrogen in Form of Dried Blood to Superphosphate or Basic Super.

These remarks apply only to those trials in which blood was used at the rate of 1 cwt. per acre. The trials numbered seven. The average increase of phosphate plus blood over phosphate alone was 3.2 bushels per acre, the increases ranging from 0 to 5.6 bushels. In all cases the blood and super were mixed and sown at the time of seeding.

Results of using Soluble Nitrogen in Conjunction with Superphosphate.

In all, twenty-five trials have now been completed in which soluble nitrogenous fertilizers have been tested. In twenty-two of these trials nitrate of soda was used at 1 cwt. per acre (except in three cases where only $\frac{3}{4}$ cwt. was applied). In the other three trials sulphate of ammonia at $\frac{3}{4}$ cwt. was used. Both forms have been applied in spring, generally on autumn- or winter-sown wheat which had received 1 cwt. of super per acre at seeding.

Only in four experiments has the nitrogen failed to increase the yield. On the remaining twenty-one trials the increases ranged from

1 to 11.1 bushels per acre. *The average increase from all trials resulting from the use of soluble nitrogen has been 5.1 bushels per acre.*

On one farm nitrate of soda has been used for four successive seasons. Every year the increase resulting from its use has been between 5 and 6 bushels per acre.

Cost of Nitrogen.

The market prices for nitrate of soda and sulphate of ammonia in recent years have ranged from 18s. to 21s. per cwt. in the case of the former, and from 15s. to 25s. in the case of the latter. At these prices the use of nitrogen would not appear to be a tempting practice. It is confidently expected that certain soluble nitrogenous fertilizers will be procurable next season at about 12s. 6d. to 13s. per unit of nitrogen. This is equivalent to 12s. 6d. to 13s. per hundredweight for sulphate of ammonia, which contains 20 per cent. of nitrogen. At this price a little over $2\frac{1}{2}$ bushels of wheat at 5s. per bushel will pay for the manure, and if future results confirm those of the past it is evident that on the average the use of 1 cwt. of one of the ordinary soluble nitrogenous fertilizers will result in a further profit over that from super of about 12s. per acre.

Earlier in this article it was shown that super will give a clear profit of about £1 per acre on an average, and the indications are that by using nitrogen as stated this profit can be increased to about £1 12s. per acre.

Results of adding Potash to Superphosphate.

In nineteen trials 1 cwt. of muriate of potash has been added to 1 cwt. of super and the mixture compared with 1 cwt. of super alone. The manures have been applied with the seed, and in the majority of cases the use of the potash has delayed and in some cases depressed germination. The depressing effect of potash on germination and the growth of seedling plants when it is sown with the seed has also been reported on by workers in other parts of the world.

In one case in the experiments under review an actual depression in yield of over 4 bushels to the acre occurred with the use of potash. In five experiments the potash actually increased yields, but to a profitable extent in *one* case only, when the increase amounted to 4.6 bushels per acre. No other increase has exceeded 2.3 bushels. For the above-mentioned nineteen trials the average increase of super plus potash over super alone has worked out at 0.3 bushel per acre.

Effect of using Potash in conjunction with Super and Nitrogen.

During the seasons 1925-26 and 1926-27 sulphate of potash at $\frac{1}{2}$ cwt. per acre was used as an addition to 1 cwt. of super and 1 cwt. of dried blood in seven trials. An increase of 2.7 bushels could be attributed to the potash in one case. Apart from this no significant increase occurred. In the seasons 1927-28 and 1928-29 the use of 1 cwt. of muriate of potash was adopted, and out of twenty trials only one gave a significant increase, amounting to 2.5 bushels, due to potash.

In six of the trials the use of potash in conjunction with super and nitrate of soda has caused the yield to be reduced to below that given by super and nitrate of soda alone. The depression in every

case was significant, and ranged from 1.4 to 6.5 bushels per acre. It was in some of those experiments in which potash added to super caused increases (see preceding section) that a number of the above-mentioned cases of depression occurred. Further, in none of the cases in which potash was added to super and nitrate of soda has a beneficial effect been recorded.

The average yield of the super plus nitrogen plus potash treatment in the twenty trials is 1.3 bushels *lower* than the average of the super and nitrogen treatments. An interesting chemical research problem presents itself in regard to what factor or factors are responsible for the depression in yield which sometimes accompanies the use of the fertilizers as mentioned above.

No beneficial effects from potash in assisting the crop to resist disease have been observed in the experiments.

Effect of Prior Crop on Phosphate Response in Wheat Crop.

The argument that the use of phosphate is not economical on the wheat crop sown on a paddock which has been in grass just previously is often advanced. The following analysis of the increased yields resulting from super on thirty-one experiments is of interest.

Table showing Relationship between Wheat Response to Phosphate and Prior Crop.

Crop preceding Wheat Experiment.	Number of Times Crop in Column 1 preceded	Average Increase due to Super. (Bushels per Acre.)	Range of Increase. (Bushels per Acre.)
Grass	7	5.4	1.8 to 7.2
Wheat, oats, barley .. .	9	4.0	0 to 10.3
Potatoes .. .	9	5.6	0 to 10.8
Peas or vetches .. .	5	3.1	0 to 8.1
Rape	2	3.0	2.7 to 3.3

Alleged Bad Effect of Superphosphate on Maturity of the Crop.

The statement that superphosphate causes an excessive spring growth and fails to "carry the crop on" or "blights it off" is often made by farmers. Super certainly does, as a rule, hasten tillering and growth in the spring. When this occurs the crop will often mature from two to five days sooner than a portion of the same crop which has not been manured, or which may have been manured with a slow-acting phosphate such as Ephos or Nauru. The early ripening is then interpreted as failure to "carry the crop on," or as "blighting off."

So far as the experience gained from the experiments under review is concerned, the features of rapid spring growth and early ripening *are almost infallible indications of increased yield, and the more marked these features are, the greater the increase.* Their non-occurrence does not necessarily mean no increase. In fact, on heavy-yielding land it is sometimes extremely difficult to detect differences. A 5-bushel increase in the case of a 50- to 60-bushel crop is practically impossible to detect by observation.

The effect of super on growth is never apparent until from three to eight weeks after the plants appear above ground. The cycle of

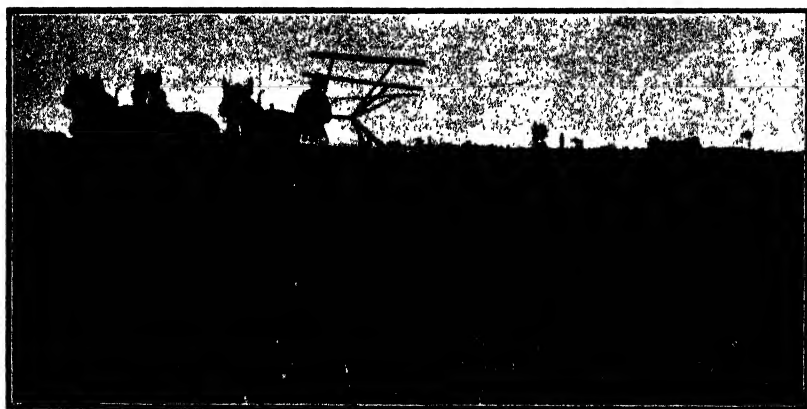


FIG. 3. CUTTING PLOTS OF A MANURING EXPERIMENT WITH A HORSE-DRAWN REAPER-AND-BINDER.

A straight cut is first made across the ends of all plots. In cutting each plot the outside divider of the binder can be easily guided down the 11-in. space. By driving the machine about 18 ft. past the end of the plot the last of the material cut is delivered on to the binding-table. The trip is then pressed and the material discharged, leaving the machine clean before the next plot is commenced.

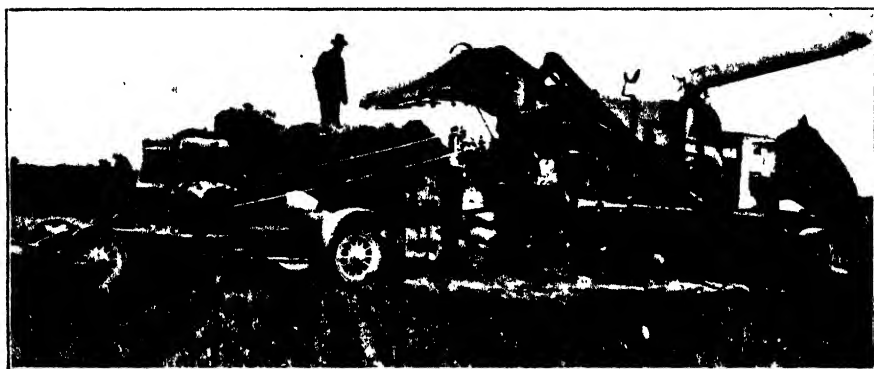


FIG. 4. THRESHING PLANT USED IN THE 1928-29 SEASON.

This plant was highly successful, and, besides reducing the time required in setting and threshing, transport from farm to farm was greatly facilitated. About three times as much work was accomplished in the 1928-29 season as in the previous one, and was also done in a shorter time. On threshing each plot (five to ten sheaves) all the grain is allowed to run out of the machine before the next plot is commenced. The running-out process occupies about half a minute. In good threshing about forty plots (each of seven or eight sheaves) per hour can be put through with ease.

events is generally as follows: Between three and eight weeks after coming through, the super-treated crop grows more rapidly, tillers better, and has a darker colour than "no-manure." Superiority of growth and tillering continues, but the colour of the super crop gets lighter, while the unmanured crop gets darker in colour. This lightening of colour of the super-treated crop probably indicates an out-stripping of growth in relation to proper nitrogen-supply, and it is on such crops that nitrogen can be expected to be beneficial. About

November, differences in growth may be hard to detect. In December the crop having super will generally come into ear a little earlier, and this position is usually maintained until the crop is mature, when, apart from stage of maturity, differences may be difficult to observe.

Effect of Early Maturity caused by Super on the "Sample" or Size of Grain.

The effect of manures on the size of the grain is being investigated in connection with all trials, and, although no report has yet been published, all evidence to date indicates that superphosphate-treated wheat has a heavier grain than wheat not manured.

No Evidence that Manuring with Super causes Lodging on Heavy Soils.

So far as could be determined in the experiments on those soils where there is a tendency for the crop to go down at harvest-time, the use of super does not cause the crop to lodge any worse than where no manure is used.

Effect of Soluble Nitrogenous Manures on Appearance and Maturity of Crop.

About one month after application the colour of the crop darkens considerably, and an increased growth may occur. This persists until the crop comes into ear, which it does at a *later* stage than crops having no nitrogen. This lateness is not observed at maturity. In fact, a superphosphate crop responsive to applied nitrogen generally ripens a day or two earlier even than one having superphosphate alone. Hence nitrogen reduces the time between the coming-into-ear stage and the ripening stage by a few days.

More Common Forms of Soluble Nitrogen on the Market in New Zealand.

These fertilizers, together with their respective percentages of soluble nitrogen, are as follows: Nitrate of soda, 15.5 per cent.; Nitro-Chalk, 15.5 per cent.; sulphate of ammonia, 20 per cent.; calcium cyanamide, 19 per cent.; Urea, 46 per cent.

The price per ton varies considerably at present. The use of any of the first four is recommended for the wheat crop. It is evident that a form containing 20 per cent. of nitrogen (the essential fertilizing element) is worth more than one containing 15.5 per cent. To estimate the value per unit of nitrogen the price per ton is divided by the percentage of nitrogen. For example, suppose nitrate of soda can be procured at £12 per ton, and sulphate of ammonia at £13 per ton, the following calculations should be made:—

Nitrate of soda, $\frac{£12}{15.5} = 15s. 6d.$ approximately per unit of nitrogen.

Sulphate of ammonia, $\frac{£13}{20} = 13s.$ per unit of nitrogen.

Sulphate of ammonia is thus the cheaper form.

Recommendations to Farmers.

(1) *Use at least 1 cwt. per acre of superphosphate at time of sowing, irrespective of the previous crop.* The use of greater quantities is not intended to be discouraged here, but until increased quantities are tried out no definite recommendations are justified.

Do not be discouraged by the fact that super is a little difficult to drill satisfactorily in damp weather. The drill stars should be removed and scraped at least once a day. The use of slow-acting phosphates is not justified simply because they run through the drill more satisfactorily than super. It is the solubility of super which enables it to act quickly and effectively, and most soluble fertilizers are troublesome to sow on account of the fact that they absorb moisture from the atmosphere in the same way as common salt.

(2) The use of potash on wheat *cannot be recommended* at present. Future work may reveal certain advantages which have not yet made themselves apparent.

(3) *Make a trial dressing of soluble nitrogen in the spring on crops which have been sown with super.* It is considered that not sufficient work has yet been done to warrant recommending a general dressing of nitrogen. Farmers are advised to purchase a few bags of one of the more common nitrogenous manures, and to top-dress a few strips in each wheat-field at the rate of from 1 to 2 cwt. per acre, according to the nitrogen content of the fertilizer used. The crops most likely to show an *easily discernible* response are those which are inclined to be light in colour about the end of August or during September. For trial purposes the quantity applied per acre should not be stinted, because where observation is being relied upon to indicate response the effect of a fairly large quantity will be more easily detected.

Make the application some time in September. This may not be the best time, but until further experimental work is carried out a better time cannot be recommended. Much research is required on such matters as time and quantity of application with the numerous forms of soluble nitrogenous fertilizers.

REFERENCES.

The results of all experiments on which this article is based will be found in various numbers of this *Journal* as below :—

Wheat-manurial Tests in Canterbury. Vol. 30, April, 1925, page 229.

Wheat-manurial Experiments in Canterbury, 1925-26. Vol. 32, August, 1926, page 106.

Ashburton Experimental Farm: Work of the 1925-26 Season. Vol. 33, November, 1926, page 316.

Wheat-manuring Experiments in Canterbury, 1926-27. Vol. 35, September, 1927, page 182, and October, 1927, page 251.

Wheat-manuring Experiments in Canterbury, 1927-28. Vol. 36, May, 1928, page 339.

Field Experimental Methods. Vol. 33, July, 1926, page 6.

(A separate report on the season 1928-29 wheat-manuring experiments will be published in next month's *Journal*.)

CURE OF IRON STARVATION (BUSH SICKNESS) IN STOCK.

PRACTICAL CONSIDERATION AND FARMERS' EXPERIENCE WITH IRON REMEDIES.

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It is every day becoming more evident that grassland farming must be looked at from two points of view—(1) the production of healthy pasture, (2) the production of healthy stock. Success in the first does not necessarily entail that the animals grazed will be healthy, for it has been proved in several countries that it is possible to have pasture which is healthy and normal in itself, but which fails to sustain health in the stock when grazed upon it in a manner generally found to be successful for the country concerned. In New Zealand, and probably also in other countries, this anomaly is more frequently found on abnormal soils such as the lighter volcanic loams, dune-sands, pumice-sands, and gravel soils of a light nature and coarse texture, easily leached and very subject to become dry in periods with a rainfall below the average.

On many of these lands the ordinary pasture-plants grow well, without showing any signs of disease or lack of vigour, but ruminants fail to thrive normally or to give normal yields of produce; and on the worst types of soil all the ruminant stock invariably die if not changed to pasture known to produce healthy animals, or if food supplementary to the pasture or medicine is not given. The present explanation of the puzzle is that some mineral food is not present in the pasture in sufficient quantity for the animal eating the grass as a sole ration, although obviously such mineral is present in sufficient amount in the pasture for itself. For instance, the text-books state that although iron is necessary to plant-life the merest traces only are necessary as plant food. The animal's point of view is here forgotten, for it has been abundantly proved that pasture with an iron content much lower than normal is insufficient as a sole diet for ruminants.

Thus the pasture may be healthy with but a trace of iron in its composition, but the quickly-growing ruminant or pig with a comparatively high demand for food iron cannot thrive, becomes anæmic, and eventually dies. This reminds one that modern grassland farming is based on the fact that pasture-plants are able to take up much more mineral food than they actually require. If it were not so it would be impossible for the dairy cow to obtain in the bulk of food it is possible to consume daily the minerals necessary to enable her to produce the high milk-yields now common. Some farmers seem to have the opinion that all elements required by the animal should be fed to it through the grass—that is to say, that the feeding of a lick to supplement the minerals present in the natural food is an unnatural or illegitimate method. This opinion appears to be a fallacy, but it is one which might be discussed with profit to all.

One of the most widely used minerals in stock-feeding is sodium chloride (common salt), and although used with certain crops (mangels, &c.) it is not generally used as a grass-manure; yet herbivorous

stock should always have access to it. There are some elements necessary to life the effect of which is to improve the yield of pasture, chief of which is phosphorus (applied as phosphates). There are other necessary elements which increase the health and vigour of plants, and on some soils their yield, such as calcium (as lime salts) and potassium (as potash salts). There are other necessary elements which do not visibly increase the health or the vigour of pasture-plants or their yield, such as iodine and iron. It is these, when deficient for stock in the pasture, which it will probably always be found desirable to feed to the stock direct. It would certainly be difficult to distribute iodine to the pasture in such a way that without undue loss the stock would get the full advantage from the amount distributed, unless it became usual to use Chilian nitrate of soda. This contains a comparatively large quantity of iodine as an impurity, and therefore not charged for.

At present it will be logical to adopt the quickest method of keeping stock healthy on "bush-sick" lands by giving iron medicinal salts as pellets, lick, or drench, or added to drinking-water or feed-milk. Top-dressing the pasture with phosphates containing iron will certainly enable stock to be carried longer than without such dressing, even on the worst soils. The best mixture for this purpose is one of equal parts of basic slag and superphosphate. Basic slag is the only commercial phosphate containing iron in appreciable amount, and, like the iodine in Chilian nitrate, it is not charged for. This slag-super mixture has been constantly advocated by the writer for many years. With turnips it is an excellent fertilizer, and it has given the largest crops of turnips ever grown at the Mamaku Demonstration Farm. The fundamental treatment necessary to convert coarse pumice lands into profitable farms is undoubtedly the incorporation of more organic matter in the soil by the ploughing-in of green crops such as blue lupins. Experiments by the State Forest Service at Whakarewarewa, and on the coarsest type of pumice soil, have shown how the quality and productiveness may be increased by this method. The organic matter or "humus" is calculated to assist in decomposing the pumice particles, and the cultivation supplies the necessary compaction of the soil. The final result is the formation of a soil which holds the water, instead of one which suffers from drought and excessive drainage. The successful farming on pumice types at the prison camps at Hautu and Rangipo must in large part be due to the organic-matter content of the black soil which often lies directly on coarse pumice.

Farmers in the pumice region are becoming more familiar with the practice of using the preparation known as citrate of ammonium and iron—the Ferri Ammon. Cit. of the druggist—which is now sold to *bona fide* settlers by the Department of Agriculture at 2s. 6d. per pound. This substance is supplied in the form of brown scales, which readily dissolve in water, and can then be sprinkled on dry rations in the bails for dairy cows, added to the milk food for calves, or mixed with molasses, salt or green bone, or a mixture of these, for store cattle. With each lot sold a leaflet giving the authoritative methods of coping with "bush sickness" is provided. Some farmers have intensified the treatment—that is, they have given larger doses—with apparent success. One farmer has used a new compound supplied by the Department's Chemical Laboratory—the finely ground native carbonate

of iron known to mineralogists as spathic iron-ore, obtained locally—and has cured three cows which were “sick.” This is a substance insoluble in water, and there will not be so much danger of giving an overdose as with the scales.

Abstracts of Farmers' Testimony.

In January of this year those farmers who had previously purchased iron and ammonium citrate scales from the Stock Inspectors at Rotorua and Tauranga were asked by circular to give their experience, since the reports received last year were favourable. (See *Journal* for May and June, 1928.) A number of these replies, which represent the latest information available, have been abstracted, retaining so far as possible the farmers' own wording, and are here published.

District D: From sea-level to about 200 ft.; only mildly “sick.”

Farmer “L” has had experience with “sick” sheep, and finds it takes about six doses to effect a cure. He successfully uses the scales in the feed-milk for calves, and finds it a good tonic for cattle.

Farmer “V” finds the use of the scales as a drench generally increases the milk-yield from the treated cows. It takes from six to thirty days before a beast shows improvement under the treatment. He is very pleased with the drug and the reasonable price charged for it.

Farmer “F” has had good results with sick cows and calves. After dosing with the scales from three weeks to a month he noticed a sick cow begin to fill out and go ahead. After this he gave each cow 1 lb. of the scales with the same good results. He uses it successfully in the feed-milk for calves.

Farmer “W” finds the method successful with cows and calves, the period of treatment with the scales being from three to four weeks.

Farmer “B” has found the method satisfactory with sick cows, about a fortnight's treatment being sufficient. He mixes the solution of the scales in water with molasses and sprinkles it on hay. He finds this method of keeping stock healthy much cheaper than changing them on to healthy country.

District E: Coastal and slightly elevated country; slightly sick.

Farmer “D” finds the calves are very fond of the scales dissolved in the skim-milk, and they are all doing splendidly.

Farmer “McG” finds that the scales have done good dissolved in the drinking-water, and thinks that the treatment has had a good effect in increasing the yield of milk.

Farmer “G” has found the use of the scales efficient for cows and sheep. The length of treatment necessary to effect a cure was about fourteen days. Given to cows in water-troughs, the remedy has a beneficial effect on their health generally. He finds it a better and cheaper method than changing to healthy country.

Farmer “V” is quite convinced that the iron treatment is beneficial, especially for calves.

Farmer “M” is of the opinion that the use of iron-ammonium-citrate scales is the surest and quickest road to success, and feels confident

that with a plentiful supply of iron any of the sick country could be farmed successfully. He has tried and constantly used the scales, and his experiences have previously been given in this *Journal* (see page 317 of the May, 1928, issue). Now, after another ten months' experience, he is still using large quantities of the drug. For animals that are sick he uses 2 oz. of solid scales as a drench each day for eight days. Before completion of the dosage the milk-flow will have increased, and both condition of animal and milk-flow will improve for about three months; cows will remain healthy for one to two years. The use of small quantities in the milk food of calves has enabled him to gain all the first prizes in Friesian calf classes in his locality at the shows. He considers the iron treatment far superior to the method of changing to healthy pastures, for the benefits are immediate and procurable just when wanted, as the cows usually "take sick" just after calving, while change paddocks are slow, expensive, and inconvenient. He has adopted the treatment on his whole herd of 120 cows, and although involving a little trouble it has paid him handsomely.

Farmer "A" used the iron scales for treating sick calves, and effected a cure in three weeks. He thinks the method much cheaper than changing.

District F: About 900 ft. above sea-level; sick country.

Farmer "M" (see also *Journal* for May, 1928) makes the valuable observation that of forty-seven cattle thirty-seven took scales readily when mixed with green bonedust, but when mixed with steamed bone only nine took the mixture. This information may prove of great value in connection with supplying a mixture which is palatable to the majority of cattle. With a salt and iron carbonate mixture supplied by the Department Farmer "M" cured three sick cows. This is the first instance of a cure being effected by the local iron compound obtained from the quarry and merely ground up. This farmer has not changed any stock for two years.

District G: Near sea-level, but inland situation; slightly sick country.

Farmer "L" has used the drug for sick calves in the milk, the length of treatment necessary generally being about six weeks, but it depended on how low in condition the animal had got. He found that the scales given with molasses and a little salt gave the best results, and were relished by the animals—"in fact, some of the yearling heifers would open their mouths for the bottle as soon as I got near them."

Farmer "M" successfully uses the scales as a lick mixed with bonedust, salt, and molasses, and as a tonic for cows in low condition in the spring, also as a drench, and dissolved in the skim-milk for the calves.

Farmer "C" gives the scales in molasses to cows and calves, and finds that three weeks' treatment effects a cure in a bad case, although he usually treats an animal until it attains full condition again. He gives 2 oz. of a 10-per-cent. solution to each calf in its milk daily, and his calves and yearlings are splendid. He also puts the scales in the water-troughs—2 oz. to 300 gallons of water. He attributes the

favourable calving and strong calves and good condition of his herd this season to the iron scales put in the drinking-water last autumn and winter.

District H : 1,760 ft. above sea-level ; very sick country.

Farmer G confirms his testimony given in the *Journal* for June, 1928 (page 403).

Farmer "B" finds that a fortnight's treatment with the scales is generally necessary to effect a cure in cows and calves ; to the latter the drug is given in the milk feed with good results. Although he lives in a very sick district, he has not changed his cows on to healthy pasture for about four years, and all the scales he uses is 4 lb. a year for fourteen cows. He gives them a total of 2 lb. mixed in bran when they come in, and another 2 lb. just before he dries them off, and has had no trouble whatever.

District I : About 1,000 ft. above sea-level ; very sick country.

Farmer "B" has had good results from dosing two cows with the scales given in eight doses spread over about two weeks.

**District J : About 600 ft. above sea-level ; sick country.*

Farmer "P" continues his experiences (*Journal* for June last, page 403), and finds that putting the scales into the drinking-troughs is the best way of administering it for cows, and in the feed-milk for calves. For cows it takes from three weeks to two months to effect a cure, depending on how far the animal has gone back. The scales are also fed in the bails in a dry ration. For the trough method $\frac{1}{2}$ lb. of the scales is dissolved in water and put in each trough every two weeks during summer for thirty-six cows. The treatment has been entirely successful for both cows and calves.

District K : Inland situation, 900 ft. above sea-level ; sick country.

Farmer "S" fed two calves going back in condition with the scales dissolved in the feed-milk, and effected a cure.

Farmer "D" uses the drug and finds it beneficial in aiding the general nutrition of dairy cows. He writes : "Am always most strongly recommending it ; by its proper use and proper farming any land in this district can be successfully handled."

Farmer "W" gives an interesting account of how a grade Jersey cow can become bush sick and practically worthless, and fifteen months later, after "changing," prove to be the second-best dairy cow in the Waikato Show.

Farmer "M" finds that treatment with the scales benefits cows and calves. Most cows benefit by one week's treatment, but some require another week's treatment later. He will always use the drug with his herd. Some cows have doubled their yield. For the calves the scales are dissolved in their milk feed. He considers that there is no need to change if one uses plenty of iron scales—"a godsend to all dairy-farmers if they will dose the cows as soon as they are noticed to be going thin, and use plenty of it."

District L : Sea-level, and only slightly affected.

Farmer "M" uses the scales for cows in the water-trough, and for calves in the feed-milk. Sick calves like it and improve very quickly. The drug is put in the trough three times a year for three weeks each time. He thinks it increases the yield of milk and butterfat. This district is a fairly healthy one, but the iron scales push on the "bad doers."

Farmer "T" puts the scales in the water-trough daily for 120 heifers which could get no other water. They kept particularly healthy.

RETIREMENT OF MR. F. S. POPE.

WE record with much regret the retirement on superannuation at the end of March of Mr. F. S. Pope, Assistant Director-General of the Department of Agriculture. Mr Pope joined the Department some twenty-nine years ago, after a considerable period of service with the Railways, and in 1909 succeeded Mr. J. D. Ritchie as Secretary of Agriculture. In this capacity he headed the Department for about ten years, including most of the difficult period of the War. He was responsible for the reorganization of the Department in 1909, the chief feature of which was the formation of the present Divisions, each under a Director. Several other important developments took place during his regime, and the establishment of this *Journal* in 1910 may also be mentioned. In 1918, when the Government decided that the Department should be controlled by a professional officer, with the designation of Director-General--Dr. C. J. Reakes being appointed to that position--Mr. Pope became Assistant Director-General. Among other valuable qualifications, he possessed a specially intimate knowledge of the many statutes administered by the Department, and was largely responsible for the drafting of these Acts and of the wide range of regulations related to them. This brief notice may fittingly be ended by quoting a remark by the Public Service Commissioner at the farewell gathering, to the effect that he always regarded Mr. Pope as an ideal Civil servant.



MR. F. S. POPE.

WALLACEVILLE POULTRY STATION.

DESCRIPTION OF THE PLANT.

F. C. BROWN, Chief Poultry Instructor, Live-stock Division.

THE Wallaceville Poultry Station is situated on part of the farm attached to the Agriculture Department's Veterinary Laboratory at Wallaceville, in the Hutt Valley, near Wellington. The plant was completed towards the end of last year. The chief objects aimed at in its establishment are as follows:—

(1) To demonstrate modern methods of poultry-management in all branches.

(2) To investigate problems relating to the breeding, housing, and general management of poultry.

(3) To investigate disease, parasitic life, and other troubles affecting poultry. This is carried out in co-operation with the officers engaged at the Veterinary Laboratory.

(4) To supply purebred birds and eggs for breeding purposes from tested stock at moderate prices.

(5) To provide an opportunity whereby the Poultry Instructors of the Department may acquire advanced first-hand knowledge in the various branches of poultry-management, which in turn can be passed on to poultry-keepers during visits of instruction, and also by lectures, demonstrations, and printed matter.

The station consists of about $3\frac{1}{2}$ acres, in which is included an area for the growing of green feed. In addition to the main plant several colony houses are located near by. These are at the edge of a clump of native bush, which provides ideal conditions for the promotion of sound development in the growing stock after they have passed the brooder stage. The site of the station generally is dry and well sheltered, with good drainage, but the ground is rather stony. The wind from the south is broken by a belt of pine-trees, and from the north by natural bush. (Fig. 1.)

It is not intended in this article to do more than touch briefly on matters concerning the plant and stock. It is proposed to include fuller details of construction, together with working-plans, &c., in a revised edition of Bulletin No. 66, "Utility Poultry-keeping," which is at present being prepared. In planning operations the chief object aimed at was to provide conditions which go to make fowls comfortable and promote good health and vigour. The factors of economy in the cost of construction, minimizing of labour in attending to the fowls, and comfort of the attendants in carrying out their work, especially in bad weather, were also taken into account. While the plant presents an attractive appearance, in no section of it has extravagance been introduced.

The buildings are solidly constructed, as should be the case with any permanent structure. It will be seen by the photographs that the whole of the poultry-houses are of the lean-to type, a style which is suitable for the housing of poultry under varied climatic conditions.

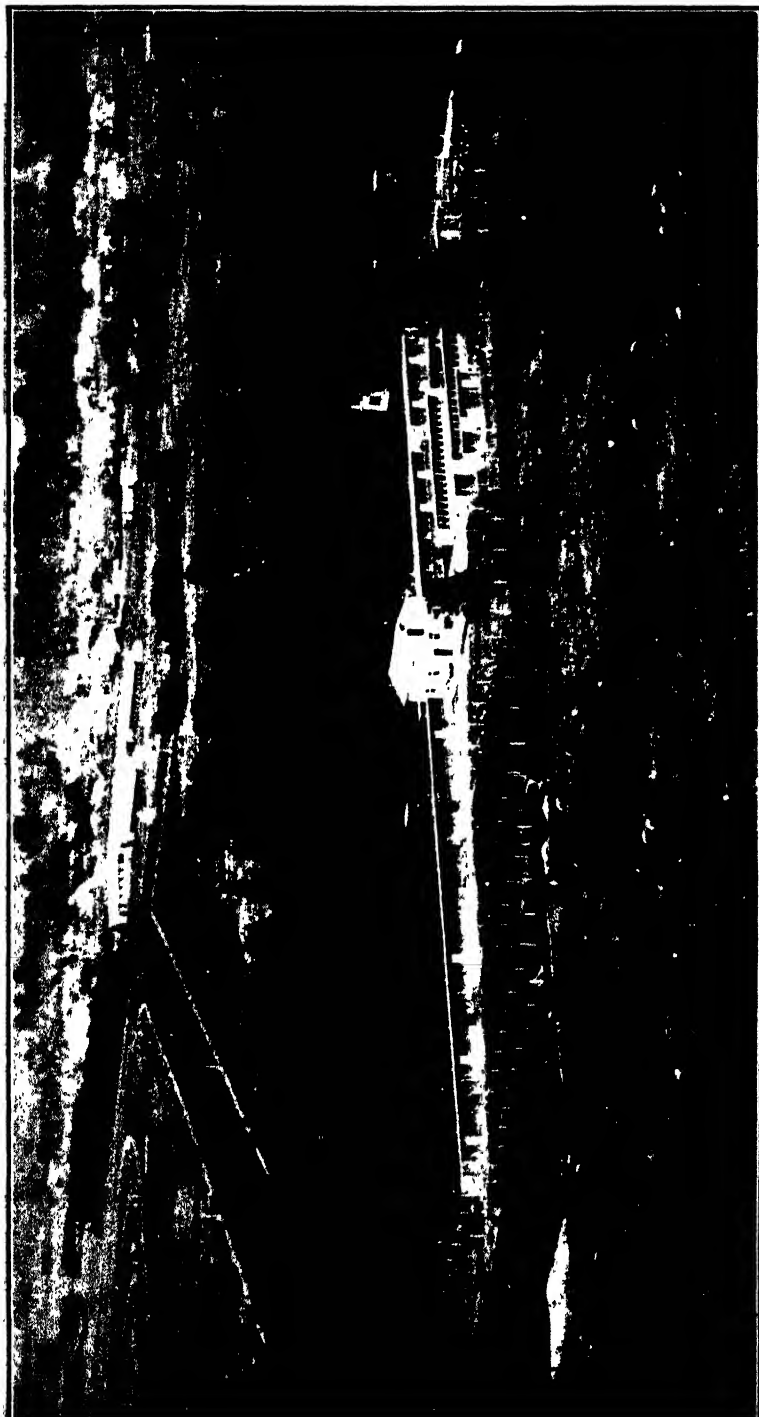


FIG. 1. GENERAL VIEW OF THE WALLACEVILLE POULTRY STATION.

[Photo by H. Drake.

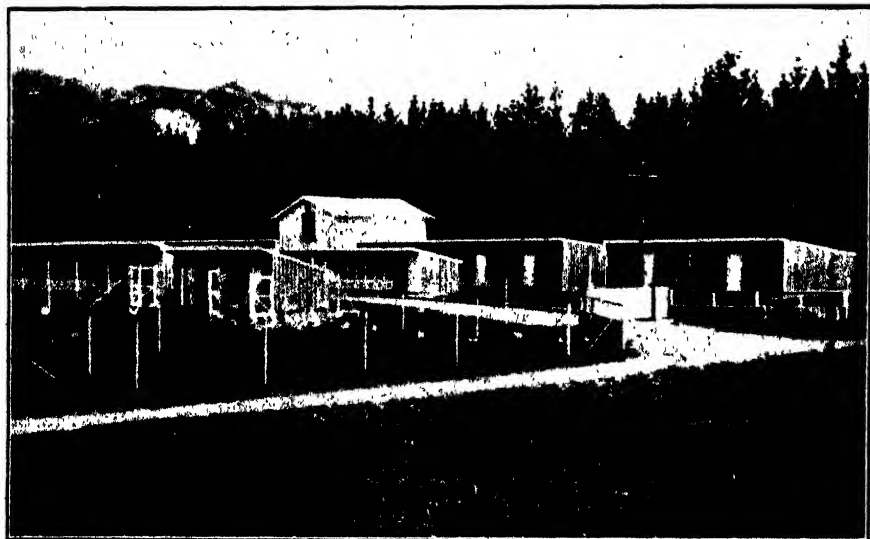


FIG. 2. THE PLANT AS VIEWED FROM ENTRANCE ROAD.

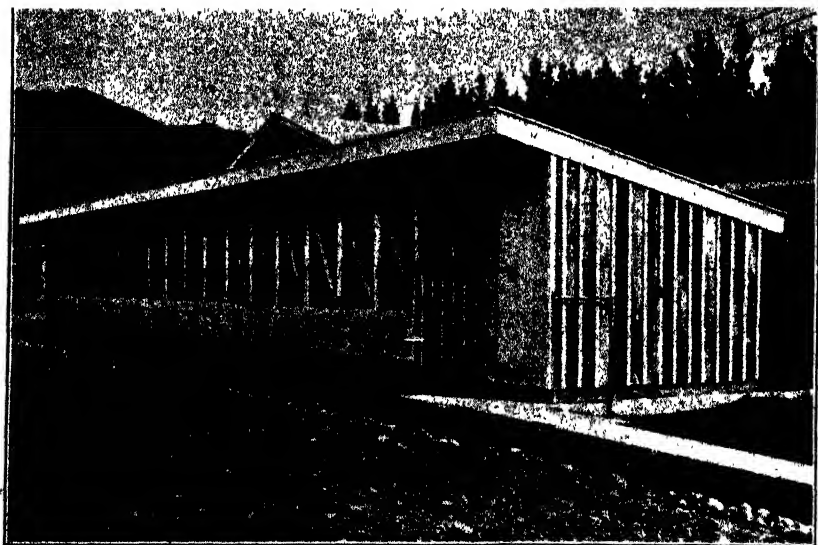


FIG. 3. A RANGE OF SINGLE PENS.

[Photos by H. Drake.]

Fig. 2 shows the entrance to the plant. On the left as one enters are seen the experimental pens (facing outwards), and on the right is a range of single pens (Fig. 3). In each of the latter an individual pullet is placed and maintained for one year. In this way the most desirable breeding specimens are discovered—those which give a heavy production of good-sized marketable eggs. Before the pullets are placed in the pens they are carefully selected according to breed type. In addition care is taken that they conform to standard weight requirements. Thus beauty—in other words, breed type—is happily combined with utility, which should always be the case. The back wall and intersecting partitions are of asbestos slate. The birds are fed, watered, &c., by means of tins which are in turn let in and withdrawn through

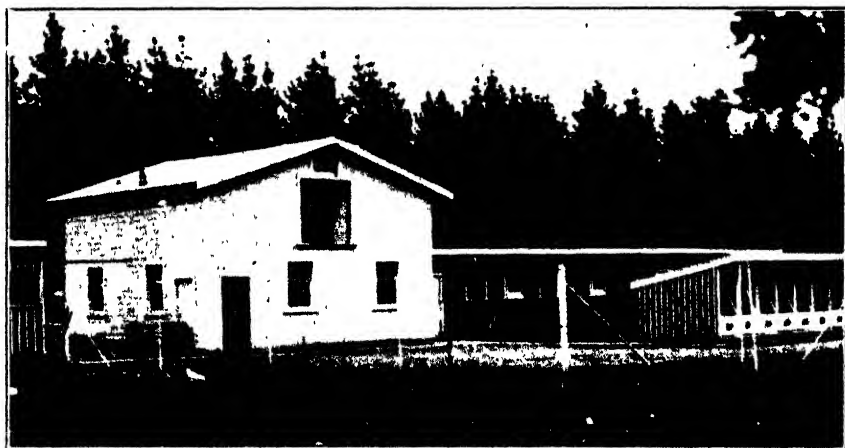


FIG. 1. CENTRAL BUILDING, CONTAINING FEED AND STORE ROOMS, INCUBATING-ROOM, OFFICE, ETC.

[Photo by H. Drake.]

the door, and which rest on a shelf fixed to the inside of the door. By this method the work may be carried out without opening the door, and with a minimum of labour.

The first building to be seen at the back of the single pens on the right is a double house used chiefly for breeding-pens. The next section of houses, adjoining the central building, consists of the brooding-quarters, and is divided into compartments to suit the various classes of brooders that are used.

The ground floor of the central building (Fig. 4) is taken up by the feed-room, incubator-room (in which the grading and packing of eggs is also carried out), and the office. The second story provides for a storeroom, grinding machinery (driven by motor power) and bins for holding the various kinds of food used. As will be seen in Figs. 5 and 6, the food is delivered in chutes from the bins to the feed-room below. The sacks of grain, &c., are lifted from the lorry on arrival

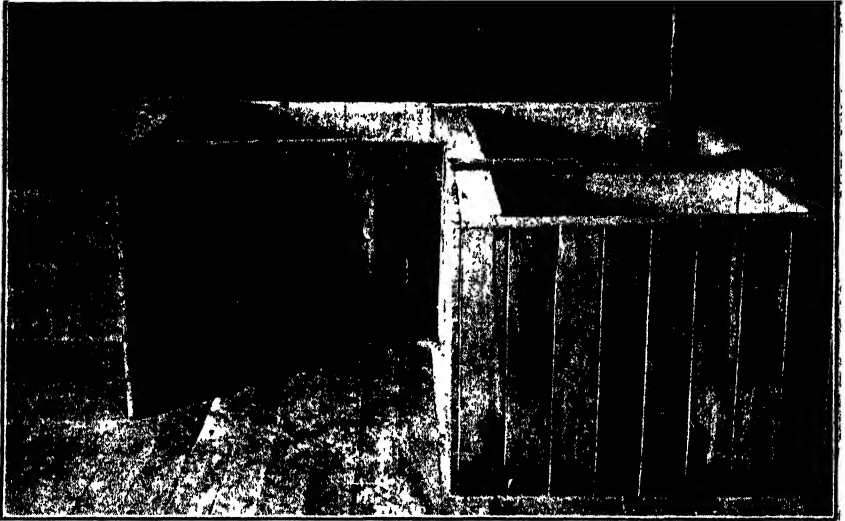


FIG. 5. STORAGE-BINS FOR FOODSTUFFS ON UPPER FLOOR OF CENTRAL BUILDING.
Chutes convey the food to feed-room below.



FIG. 6. FEED-ROOM ON GROUND FLOOR, SHOWING, CHUTES, MIXING-TROUGH,
BOILER, ETC.

Photos by H. Drake.

by means of a motor-driven hoist. In this process the sacks are swung over the bins, opened, and emptied into them. It will thus be seen that the labour in handling feed is reduced to a minimum.

Continuing, one comes to a range of laying-houses and breeding-pens (Fig. 8), the latter being at the far end. These houses are 20 ft. deep, and are divided into compartments to suit the purpose for which required. The back and intersecting walls are of asbestos slate, which is an excellent material for the purpose. It not only provides a draught-proof wall, which is an essential for the well-being of fowls, but in addition it eliminates harbouring-places for vermin.

SOME PARTICULARS OF CONSTRUCTION, EQUIPMENT, ETC.

Foundations and floors : Throughout the whole of the buildings of the plant these are made of concrete. This is preferred to other materials commonly used for floors—firstly, because the dust nuisance is reduced to a minimum ; secondly, because the presence of rats is discouraged ; and, thirdly, because disease, parasitic life, and other troubles that affect poultry are more easily prevented and controlled than when earth or wooden floors are used. At all times the floor is well bedded down with straw litter, which not only prevents the fowls from injuring their feet when jumping down from perch or nest, but also provides good exercise for the birds in searching for their grain food, which is fed in the litter.

Roofs and walls : All roofs are covered with corrugated iron. Before the sheets are nailed on, however, and as a means of preventing sweating during frosty weather, 2-in.-mesh wire netting is stretched tightly over the rafters, and on this is placed a good grade of building-paper.

The weatherboards at the ends and front of the building are placed vertically, and the joints are covered with battens. In this way the walls are made draught-proof. To preserve the wood the walls on the outside have been given a coating of Stockholm tar. This, together with the battens, which were painted white before being nailed on, gives the whole a good appearance.

Ventilation : As will be seen in Fig. 8, a portion of the front wall is left open for this purpose and to admit the sun's rays to the interior of the house. An additional space for ventilation is provided between the top wall-plate and the roof at the front of the house. A space is also left open at the back, between the top wall-plate and the roof. This back ventilation-space is so arranged that it can be opened or closed, according to the season of the year and prevailing weather conditions. With this system of ventilation the bad air finds an escape at the top of the front of the house, and is replaced by fresh air from the back. These spaces are covered with small-mesh wire netting to keep small birds out. The brooding-quarters are ventilated in a similar manner. In this case, however, a curtain attached to a light wooden frame is hinged to the plate on the inside of the house above the wire netting. The frames are arranged so as to fit in between the studs, and can thus be hooked up or closed down according to weather conditions.

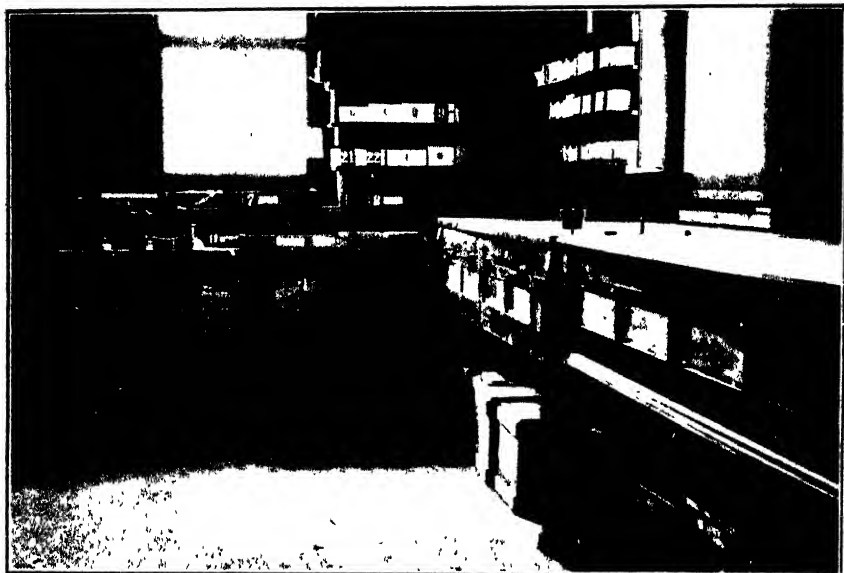


FIG 7. PART OF THE INCUBATOR-ROOM; ALSO SHOWING EQUIPMENT FOR EGG-GRADING AND PACKING.

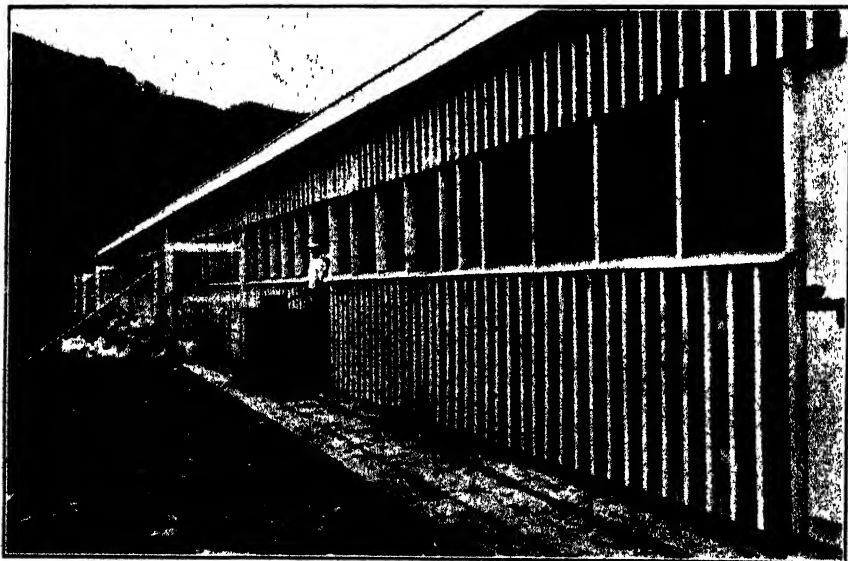


FIG. 8. RANGE OF LAYING-HOUSES AND BREEDING-PENS, WITH SERVICE TROLLEY ON RAILS.

[Photos by H. Drake

Interior fittings: Fig. 9 shows the interior of one of the laying-houses. The perches are hinged to studs on the back wall, and can be hooked up during the day. By this arrangement the birds are prevented from perching during the day, and are thereby encouraged to take plenty of exercise. Another advantage of having the perches fixed in this way is that it gives a clear floor for the work of cleaning the house and classifying stock, which can be better carried out and in less time than when the perches or their supports are in the way.

As will be seen, the nests are made from petrol-tins with the top and two-thirds of one end removed. A three-cornered piece is also



FIG. 9. PART OF INTERIOR OF A LAYING-HOUSE.

Photo by H. Drake.

removed from the centre of each side to a similar depth as the front. It has been found that by removing the parts referred to from the sides of the tin the hens can see each other when visiting the nests, and they do not crowd into one or more of the latter, as is often the case when these parts are not removed.

The watering of the fowls is done automatically. To the right of the nests in the photo is seen a water-vessel on an elevated shelf against the end of the house, placed sufficiently high to prevent litter from getting in. On the right of this is shown part of a three-compartment broody coop.

Dust-baths are provided in each house. Wooden frames are made in which is placed suitable dusting-material, such as a mixture of sand, ashes, soil, &c.

Service trolley: Fig. 8 shows a trolley run on light rails, the latter being set into the concrete path. The trolley has proved to be of special service in facilitating the work of cleaning the houses. The rails extend to the area used for growing green feed at the end of the section. By this arrangement the manure from the houses is easily transferred to this area, and the green material to the fowls therefrom. The trolley is also found useful for transferring fowl-crates from house to house at culling-time, &c., and for conveying foodstuffs from the feed-room in buckets made from petrol-tins. The ends and sides of the trolley are removable, and are taken off when it is being used for the latter purposes.

Runs: In order to prevent the ground from becoming tainted large runs are provided at both front and back of the houses. In this way they can be used alternatively and allowed to sweeten. The ground taken up by the back runs consisted of a fully grown apple-orchard when the plant was established, and the trees provide ideal shade for the birds during sunny weather. Up to the present the fowls have in no way damaged the trees, and it is expected that in course of time the droppings of the fowls will have a beneficial effect on them.

Fences: These are made of 6 ft. wire netting. For posts (excepting the strainers) discarded locomotive-boiler tubes are used. Holes are made in each at top, centre, and slightly below ground-level. The posts are 12 ft. apart. A well-strained wire is used at the top, centre, and bottom of the posts. As it may be found necessary to renew the posts in course of time, it was considered inadvisable to pass the wires through the holes referred to. The wires are fixed to the posts by short pieces of thin wire passed through the holes. The bottom wire is threaded through the netting to strengthen it, and to enable it to be firmly pegged down with wire staples in a trench 3 in. deep.

GENERAL.

The breeds at present kept at the station are White Leghorn, Black Minorca, and White Plymouth Rock fowls, and White Indian Runner ducks. The question of bringing in another heavier breed of fowls, and also one of ducks, is being considered.

Various makes of incubators and brooders are being tested. Some of both appliances are heated by electricity.

Visitors are invited to inspect the plant on week-days between the hours of 9 a.m. and 3 p.m. On Sundays they are not admitted, except by special arrangement.

Shelter-belts and Atmospheric Conditions.—An important point which is often overlooked when considering the value of shelter on the farm is that of temperature. A calm atmosphere is conducive to humid conditions, and warmth and moisture are essential if a rich succulent growth is to be promoted. There are comparatively few districts in New Zealand which receive more rain than is actually necessary for the growing of crops, and therefore the prevention of evaporation from the soil reduces the necessity for cultivation and mulching.—*State Forest Service.*

INTERNAL PARASITES OF SHEEP AND LAMBS.

SOME NOTES ON PREVENTION AND TREATMENT.

J. E. McILWAINE, M.R.C.V.S., Animal Husbandry Section, Live-stock Division.

WHERE any class of stock is depastured for a number of successive seasons on the same paddocks, such areas very often become what is termed cattle-sick, sheep-sick, or horse-sick, as the case may be. An interchange of stock is very desirable for this reason alone. Continual grazing of the same class of stock on the same pasture is very liable to contaminate it with the eggs and embryos of the various internal parasites.

There are certain factors in late summer and early autumn which render young stock liable to internal parasites. When lambs are weaned and have to live entirely on grass or supplementary catch-crops there is always a tendency for them to receive a check, and any check at this time is liable to debilitate the animal and allow internal parasites, if present, to badly affect it. The common symptoms shown by parasite-infested stock are debility, anæmia (as shown by a certain degree of paleness of the mucous membrane), scouring, and even emaciation. Associated with the parasites which inhabit the stomach and intestines and are responsible for these symptoms, there may also be a more or less severe infestation of the parasite whose common seat is the smaller bronchial tubes in the lungs. In some cases this particular parasite may preponderate, and the common short cough indicating lung-worm trouble may be the only symptom.

If a post-mortem is held upon such an animal it is usually a very easy matter to demonstrate this worm in numbers in the smaller bronchial tubes. It is not always so easy to demonstrate the stomach worm in sheep. When such proof is necessary it is advisable to kill a lamb which is showing typical symptoms as evidenced by emaciation and diarrhoea. The stomach is then suspended and an incision made along its upper border. The contents may then be seen to be disturbed by a seething movement, indicating the presence of the worms. In some cases the parasites become embedded in the mucous membrane of the stomach, and can only be seen with a magnifying-glass or with the aid of a microscope. In cases where adult worms are numerous, if a needle is taken and drawn through the contents of the stomach some of the parasites cling to it, and can then be demonstrated by transfer to a glass containing water. If the lambs have already been dosed, few parasites may be seen in the stomach. In one case which came under my notice the large bowel and the cæcum contained large numbers of parasites which the farmer had mistaken for partly digested grass-fibres.

Diarrhoea may not be present till the trouble is far advanced, but invariably this is a common symptom. The characteristic cough is perhaps the most frequent symptom when parasites are also present in the bronchial tubes and lungs. The parasites sometimes become encysted in the lungs and set up broncho-pneumonia.

The life-history of all the parasites which infest the stomach and intestines is very similar. The adult lives there, obtaining nourishment from the partly digested food in the alimentary canal or by sucking

blood from the bowel wall. Here it lays its eggs, which leave the body with the dung. Under suitable conditions of moisture and temperature embryos hatch out from the eggs in a variable time, depending on the factors mentioned. These young parasites are capable of an independent existence for a considerable time, so that pastures once infected are likely to remain so for a long period. The parasites are capable of withstanding considerable drought and cold. The dew on blades of grass provides sufficient moisture to enable them to exist, and at night they are thought to leave the grass and seek to bury themselves in the ground, in this way resisting cold, with the exception of severe frosts. It is stated also that the larvæ of some of the parasites can remain over from one season to another; hence the necessity of dosing lambs and young stock early and as often as possible, to prevent the spread of the parasites and reduce the contamination of pastures to a minimum.

It is very probable that the adult sheep acts as a carrier of the parasites, and although able to contaminate pastures does not itself become seriously upset on account of its greater powers of resistance. On the other hand, the young lamb—more especially if it receives a check at this time of the year—having a lower power of resistance and requiring all nourishment available to build up a growing frame, is an easy prey.

All lambs, whether on infested land or not, will pay for careful attention, first to prevent a check, and secondly to ward off parasitic attack. Many farmers make it a rule to dose all lambs soon after weaning, this being repeated later on, depending on the appearance or otherwise of symptoms of parasites. A frequent change of pasture of a nutritious and easily digestible nature is much desired. Long coarse grass is quite unsuitable—in fact, dangerous—as sheep-feed; moreover, such pasture, on account of its retaining moisture better than short cropped grass, is an ideal ground for the spread of parasites. On recently visiting a farm where lambs were scouring badly, and where there was no doubt that parasites were playing havoc the feed was found to be of this nature. Where sufficient cattle are not available to eat off all such roughage the grass should be mown if a mower can be used. The young green sward of grass, either following mowing or following cattle, is excellent sheep-feed and the feed so much needed for lambs if a check is to be avoided. Excellent results are generally obtained by dairy-farmers who make a habit of buying cull lambs, either to fatten or for their own use, and who graze such lambs in paddocks eaten down by the dairy-cattle. The explanation is, firstly, that the pasture is not sheep-sick and does not contain parasitic larvæ, and, secondly, that the short growing feed is highly nutritious, having a high protein content.

As regards the actual dosing and treatment, there are various agents which are more or less effective in getting rid of the parasites. The Live-stock Division recommends the use of a 1-per-cent. solution of copper sulphate (bluestone). To make this up take $1\frac{1}{2}$ oz. of finely powdered bluestone and dissolve thoroughly in 1 gallon of water, which gives exactly a 1-per-cent. solution.

Lambs can be given 1 fluid ounce, hoggets $1\frac{1}{2}$ oz. to 2 oz., and ewes 3 oz. of this solution. An ounce equals about two tablespoonfuls. Care

should be taken to see that the bluestone is thoroughly dissolved and mixed before dosing, as any crystals escaping have a caustic action, and would therefore cause harmful results in an animal whose stomach and bowels were already inflamed by the presence of the parasites. All animals require to be fasted for at least twelve hours before dosing, and to obtain the best results it is not advisable to hurry the sheep back to pasture. After the administration of the copper-sulphate solution four or five hours should be allowed to elapse.

Lambs and sheep can be dosed every three or four weeks over a period or throughout the year, commencing in the case of lambs immediately after weaning. Pregnant ewes should not be dosed within two weeks of lambing. But it must be fully realized that medicines alone cannot always be relied upon to prevent parasitic trouble. Careful attention to the feeding conditions is the most valuable and necessary measure.

Preventive measures against internal parasites include if possible complete change of pasture. The sheep must be removed from the contaminated area, and, if the infestation is a very severe one, it is advisable to graze the area with horses or leave it vacant for not less than a year. Infested pastures may as an alternative be ploughed and cultivated, and the crops fed off by sheep. Drainage, liming, and the use of salt licks are also indicated as means to be resorted to in combating the persistence of eggs and embryos of the worms. The sheep should be dosed before being placed on fresh pasture, otherwise this in turn will soon become heavily contaminated. If possible extra feed (particularly in winter-time) in the shape of a daily ration of crushed oats, chaff, or concentrates should be fed from troughs. An allowance of hay fed from racks is also advisable, and oaten chaff is very valuable. At first sheep, and more particularly lambs, may not take to this dry feeding; there is often difficulty when green feed is abundant. Nevertheless, the absolute necessity of giving some supplementary feed in addition to dosing with medicine must be recognized. A certain amount of good can be expected from the use of medicines, but unless this is supplemented with good food the best results will not be obtained.

A few remarks may be devoted to the parasites which infest the smaller bronchial tubes, and which are the cause of what is commonly called "lung-worm" in sheep, or "husk" and "hoose" in calves. In the case of sheep it is not desirable that special treatment should be given for this particular parasite, the stomach worms being by far the more harmful in their results. It is sufficient to treat sheep for stomach parasites and to build up their constitution with good nourishing food to enable them to throw off the worms which invade or infest the lung. Medicine given by the mouth has very little, if any, effect on the lung parasites, although in the treatment of calves for this complaint turpentine in milk or oil is frequently given.

Salt licks are given for a number of stock troubles, and for internal parasites such licks as a rule contain sulphate of iron among other ingredients. Sulphate of iron is a valuable aid to other lines of treatment already mentioned, being a good tonic, and assisting in warding off the anæmia which is so common in all parasitic affections.

In these notes I have referred more particularly to the small round worms which infest sheep, and it must be emphasized that these are the

most dangerous. There are a number of flat worms which also infest sheep—namely, the tapeworms and the liver-fluke. The tapeworms, although they present a rather formidable appearance when seen in a post-mortem examination, are not nearly so dangerous as the small round worms to which chief attention has been given. Liver-fluke is very localized in its distribution in New Zealand, and has been the subject of several special articles in the *Journal*. The control measures advised have been attended with very encouraging success where efficiently carried out.

SALTY SOILS IN CENTRAL OTAGO.

A CHEMICAL STUDY OF THE SO-CALLED ALKALI PATCHES.

A. D. COLLINS, B.Sc., Chemistry Section, Department of Agriculture.

IN dry districts generally, as a result of the low rainfall, percolation through the soil and subsoil into the underground water system is not sufficient; and owing to the constant weathering of rocks, salts are produced which tend to accumulate in the subsoil. These salts are dissolved by the water remaining in the subsoil, and the resulting solutions rise to the ground surface by capillary action, evaporate under the heat of the sun, and leave a deposit of various salts which destroy all vegetation and cause sterility.

Capillary action may be brought about by sharp heavy rainfalls, which make a connection between the salty or saline subsoil water and the evaporating ground surface; or by irrigation, which drenches the ground and raises the natural watertable nearer to the ground surface; or by seepage waters, which rise to the surface in the dry basin area below the source.

This deposition of salts—called saline or alkaline efflorescence—sometimes occurs through continued evaporation of ordinary river or spring water, whereby harmful matter accumulates on the surface or the banks.

There is a constant tendency for these sterile spots to spread, especially under the influence of faulty irrigation, and the only remedy applicable is the building of drainage-channels at a lower level than the irrigation-channels, thus producing an artificial means for the percolation of salts not removed by the crops through the soil. Any loss of water by this system is amply repaid by the increased fertility of the soil.

The composition of these salts varies; sodium chloride (common salt) generally predominates, and, with the sulphates of sodium, magnesium, and calcium, forms the material called "white alkali." Sometimes the efflorescence is alkaline in solution and contains carbonate and bicarbonate of sodium. This solution dissolves some of the soil humus and also resolves some clay material into fine particles, so that when dry a hard-pan known as "black alkali" results. Among the causes of sterility the poisonous action of certain inorganic salts, such as sodium chloride, sodium sulphate, and magnesium sulphate, is one of the most

perplexing. Agriculturists are mastering the peculiarities of aeration, lime-deficiency, and texture variations due to want or excess of water, but the true factors governing the relationship between salts, soil, and plants cannot be expressed with any precision. So far, a limited number of plant-poisons have been considered, and their action is most variable; the degree of toxicity of different poisons is not the same, and the poison varies in the intensity and nature of its action on different species of plants.

Compounds of arsenic, copper, and zinc in any concentration do not seem to stimulate growth, whereas very dilute solutions of manganese, boron, and magnesium compounds decidedly increase growth. Even here the action is specific for one poison and one plant; magnesium stimulates the growth of barley, while boric acid is far more potent for peas. It seems certain that some inorganic poisons act as stimulants when present in small quantities, and others, while stimulating certain functional processes, may inhibit other associated processes. Any hindering-action is due to the relatively large proportion of them in the soils, as it has been shown that most of these toxic salts are highly beneficial if the dilution is sufficiently great. Carbonates are more injurious to vegetation than neutral salts; 0.1 per cent. sodium carbonate is toxic to most plants. Most farm crops will tolerate up to 0.25 per cent. sodium chloride in the soil, but the real danger of sodium chloride is in its attack on the double silicates of the soil, lime in particular being displaced, and the clay becoming deflocculated and remaining suspended in water for a considerable time. A comparative excess of magnesium salts over calcium salts in the soil will result in sterility; soils derived from the serpentine (which contains magnesium salts) are notoriously poor.

Referring to samples of salty soils from Galloway, Central Otago, B. C. Aston wrote in 1926: "American investigators have shown that salts of magnesia have, even in solutions of great dilution, a great toxic action on plant-roots, which is much diminished if calcium salts are present at the same time. In this case analysis shows calcium sulphate to be present, but this is much less soluble than magnesium sulphate, which might be largely in excess in the thin surface layers of soil where the salty matter is deposited. . . ." As long ago as 1909 Mr. Aston reported on a similar type of sterile soil from Nelson: "There is no doubt that many of these Nelson soils which are unproductive owing to excess of magnesia might be brought into much better condition by applications of gypsum (calcium sulphate). . . ." (Annual Report, N.Z. Department of Agriculture, 1909.)

While in some of the present analyses of the surface scrapings a high percentage of sodium chloride is shown, the quantities of magnesium, calculated as oxide, are also considerably above the concentration known to be toxic—that is, about 0.5 gramme in 100,000 parts of water. In these cases, then, it may be justly inferred that toxicity is due not simply to the sodium chloride (which would definitely be shown in the deflocculated nature of the soil), but largely to the magnesium excess over the calcium. To bring this out more clearly the surface scrapings of the salty efflorescence were analysed, and the accompanying tables indicate this point.

Table 1.—*Surface Scrapings of Salty Soil Areas.*

Lab. No.	Colour of Sample.	Locality.	Nature of Sample.	Moisture per Cent.	Loss on Ignition per Cent.	Soluble in Water.		Soluble in Hydrochloric Acid.	
						Mineral Matter, per Cent.	Organic Matter, &c., per Cent.	Mineral Matter, per Cent.	Organic Matter, &c., per Cent.
Y									
196	Grey	Alexandra, Poolburn	..	0.0154	0.0482	3.27	5.49	5.71	14.59
197	Light grey	Alexandra, Tiger Hill	..	0.0076	0.0391	5.59	7.04	39.35	19.51
198	Light brown	Alexandra, Tiger Hill	Salty incrustation in decomposed schist	..	0.0082	3.62	4.43	6.21	16.38
199	Light grey	Alexandra, Leaning Rock S.D.	Salty incrustation in decomposed schist	..	0.0092	14.85	10.55	28.17	13.64
200	Light grey	Alexandra, Leaning Rock S.D.	Salty efflorescence	..	..	12.20	..	4.75	12.32
201	Brown	..	..	..	0.0084	12.47	13.55	7.43	14.34
202	Light grey	Cromwell, Wakefield S.D.	..	0.0183	0.1010	7.28	9.14	8.70	13.72
203	Brown	Cromwell, Wakefield S.D.	Black salty soil	..	0.0092	4.19	10.02	8.26	26.06
204	Grey	Cromwell, Wakefield S.D.	Black salty soil	..	0.0028	3.40	7.32	6.66	16.10

Table 2.—*Percentage Mineral Content of Water Extract.*

Lab. No.	Magnesium Oxide, MgO	Sulphate as SO ₃	Chloride as Cl	Silica, SiO ₂	Calcium Oxide, CaO	Alkalies, Na ₂ O, K ₂ O
Y						
196	0.005	0.47	1.66	Trace	0.38	1.05
197	0.20	0.54	0.11	Trace	0.24	0.72
198	0.26	0.19	1.37	Trace	0.10	0.68
199	0.10	1.18	0.66	Nil	4.35	3.42
200	0.23	1.33	1.18	Trace	0.19	5.74
201	0.18	0.75	2.50	0.04	0.80	4.97
202	0.003	0.56	0.27	Trace	0.0009	3.91
203	0.52	0.03	0.37	Nil	2.21	0.89
204	0.097	0.12	0.14	Trace	0.0004	2.39

Table 3.—Comparison between the Bases
(Water-soluble).

Lab. No.	Magnesium Oxide. MgO	Calcium Oxide. CaO	Alkalies. Na ₂ O K ₂ O
Y			
196	0.35	26.48	73.17
197	17.24	20.69	62.07
198	25.00	9.61	65.39
199	1.27	55.27	43.46
200	2.88	54.37	42.75
201	3.03	13.44	83.53
202	0.08	0.02	99.90
203	14.36	61.05	24.59
204	3.89	0.02	96.09

Table 4.—Magnesia calculated as
Sulphate (Water-soluble).

Lab. No.	Anhydrous MgSO ₄	Crystalline MgSO ₄ 7H ₂ O
Y		
196	0.014	0.029
197	0.60	1.22
198	0.78	1.59
199	0.29	0.60
200	0.69	1.41
201	0.54	1.10
202	0.009	0.018
203	1.55	3.18
204	0.29	0.59

In samples 198, 202, and 204 the magnesium is sufficiently in excess of the calcium to be poisonous to plant-growth, and samples 196, 197, 198, 202, and 204 have a very high sodium content. Whether this latter is chiefly present as chloride is difficult to discover. Analytical figures for such soils are hard to refer or arrange as combined acid and base radicles—that is, as definite compounds. Therefore, not knowing the true nature of the salt present, it would also be impossible to state that the calcium exists there in a form which inhibits or restrains the toxic effects of magnesium salts. It seems likely that in most of the soils studied in this connection the magnesium plays the most important role as toxic, while the sodium chloride brings about a degradation of the soil and further accelerates the formation of the efflorescence.

The quantity of salt present is now recognized as of hardly so much importance as its physiological action and its influence in association with other salts. It is conceivable that sodium and potassium salts catalyse or make possible the effects of other salts, and thus bring about a peculiar condition which may be either toxic or stimulative, according to the nature of the plant, the soil, and the climate.

Effect of Shelter on Farm Crops. The following description of two typical instances recently observed on the Canterbury Plains will serve to illustrate the effects of shelter on crops. A field, completely protected from the north-west with the exception of one corner, was carrying a magnificent crop of oats. In three days a gale thrashed the exposed corner to the ground, while the sheltered crop remained unharmed. Along the same road there lies a big grazing-paddock, one half of which is protected by two fine belts of trees from the north-west and south-west. The owner has been recording the variation in feed-value between the two sections of this paddock, and for this reason has been very careful to fertilize and stock the whole area uniformly. Past records show that originally the whole area was of equal soil-quality, but to-day there is a remarkable difference, for on the sheltered end the valuable fodder grasses have formed a fine sole, while on the exposed end there exists little but native grasses and weeds, the line of demarcation being quite clear. This clearly demonstrates that the finer grasses cannot thrive when exposed to parching summer winds and cold blasts of winter, but that the effect of both these conditions may be overcome by careful and thoughtful planting.—*From State Forest Circular No. 25.*

THE FERTILIZERS ACT AND REGULATIONS.

REGISTRATION AND OTHER PROVISIONS.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

THE Fertilizers Act, 1927, came into force on 1st June, 1928, and necessary regulations under the Act were gazetted on 4th October following. A summary of the main points of the new Act appeared in the *Journal* for December, 1927. As all registrations of vendors and brands of fertilizers must be renewed in the month of June, the time is opportune to review briefly the requirements of the Act and regulations for the information of manufacturers, traders, and users of fertilizers.

The Act defines "fertilizer" as any substance used for enriching the soil and in a state suitable and intended for application to the land, and which contains in appreciable amount nitrogen, phosphoric acid, or potash. It does not include lime, stable manure, or crude refuse which has not been specially prepared. *It is an offence to sell as a fertilizer any substance for which a brand could not be registered under this Act.*

All sales of fertilizer in quantities of less than 5 cwt. are exempt from the provisions of the new Act, and traders, such as retail seedsmen and florists, who sell only small quantities of fertilizers, are no longer required to register as vendors.

Registration.

Vendors are required to register their names and addresses in the month of June each year (or before the sale of any fertilizer), and those who are manufacturers, mixers, or importers must deposit a statement describing the brand and composition of each fertilizer, and must receive a certificate of registration of the brand before offering such fertilizer for sale. Vendors who do not manufacture, mix, or import fertilizers will now register in a simplified form. No details other than those of brand, name of fertilizer, and name of manufacturer or importer are required in their case.

The manufacturer or importer is now required to state not only the percentages of the fertilizer ingredients, but the actual percentages of the components (such as super, blood-and-bone, &c.) in the mixture, including the nature and amount of any filler or diluent. On the other hand, he is no longer required to declare "unit values," or the "equivalents" in tricalcic phosphate and sulphate of potash. The term "phosphoric anhydride" has been superseded by the more commonly used "phosphoric acid." Briefly, the particulars to be supplied for registration have been simplified and made more intelligible to the purchaser, who receives a copy of the statement in the form of an invoice certificate with every lot of 5 cwt. or more.

The Act provides that no brand shall be registered if it is the same as or similar to a brand already registered. It is a common practice for traders to have fertilizers prepared or mixed by manufacturers and packed in bags bearing the trader's special brand. A trader might thus have mixtures prepared by several manufacturers, each of whom would apply for registration of the trader's brand.

Under the new Act such duplicated registrations of any brand cannot be accepted. To simplify the procedure, therefore, the owner of any special brand, though he may not actually manufacture or mix fertilizers, should apply for registration of the brand. The manufacturer will then supply the fertilizer to the trader as a sale of "special mixture" in bulk, to be bagged in the trader's branded bags, and the brand will not be registered by the manufacturer. This procedure applies to any case in which a manufacturer mixes fertilizers to order for a trader and does not offer such fertilizers for general sale.

IMPORTED FERTILIZERS.

Importers of fertilizers are required to register in the same manner as manufacturers, and any firm importing a mixed fertilizer should obtain from the manufacturer the necessary particulars of the components. It should be noted that a mixed fertilizer is one in which the components are incorporated mechanically, and not by chemical process. Such a fertilizer as basic superphosphate, in which the lime reacts chemically with the phosphate, is not a mixture within the meaning of the Act, and the necessary amount of lime required to bring about complete reaction is not a "filler or diluent" in this case. In the case of imported fertilizers the overseas manufacturers' brands may be specified in the application for registration, but it should be clearly understood that no importer can be given the exclusive right to any of such brands.

CO-OPERATIVE CONCERNS.

Section 20 of the Act provides for importers or purchasers of fertilizers who are not actually traders. Co-operative dairy companies, for example, import or purchase in New Zealand fertilizers for distribution to their members, and such companies are not vendors as defined by the Act. When a co-operative concern imports a quantity of fertilizer, a sample is to be forwarded to the Chemist, Department of Agriculture, Wellington, with a statement (Form Ag. H./223) showing the particulars of composition, &c. A copy of these particulars is also to be supplied to each person receiving portion of the consignment. The position of indent-agents who transmit orders but who do not actually make sales of fertilizers is also covered by this section. When fertilizers are purchased in New Zealand by co-operative societies a copy of the vendor's invoice certificate is to be supplied to each recipient of the fertilizer, but no sample need be sent to the Chemist.

POINTS IN APPLICATION FOR REGISTRATION.

In completing the form of application for registration (Ag. H./87), attention to the following points will avoid much subsequent correspondence :—

(1) *Facsimile of brand* : A brand must be supplied for each fertilizer. To offer fertilizer for sale in unbranded packages renders the vendor liable to prosecution. The design of the brand must be clearly shown, but where a number of mixtures are sold under the same general brand it is sufficient to state the brand once only, and to indicate the distinguishing marking or wording in respect to each fertilizer of the series.

(2) The percentages of the fertilizer ingredients are not infrequently entered under the wrong headings. In such cases the forms have to be returned for correction, with consequent delay in completing registration.

(3) Citric-solubility may be stated on the registration form and invoice certificate at the option of the vendor. If it is so stated, the effect is that of a warranty.

(4) Fineness of grinding: This must be stated in the case of basic slag and ground rock phosphate, whether alone or in mixture.

(5) The components (including filler, if any) and their respective percentages must be clearly stated.

(6) In the case of a firm with several branches it is not necessary to make a separate application for registration of each branch. One form showing the various addresses will suffice.

Sampling and Analysis.

The regulations prescribe the methods of sampling and analysis of fertilizers. Under the Act of 1908 the vendor from whose premises a sample was taken for analysis was supplied with a copy of the Analyst's certificate. The new Act cancels this obligation, but permits the vendor to obtain a copy of the certificate on payment of the prescribed fee, which is fixed by regulation at £1 1s. A copy of the certificate is, however, supplied to the vendor without cost if the analysis discloses any discrepancy materially to the prejudice of the purchaser.

The provision in the Act of 1908 whereby a purchaser might, on application to an Inspector and payment of a fee of £2 2s., have a sample taken from a consignment of fertilizer supplied to him has been continued, but the time after delivery of the fertilizer within which notice to take samples may be given to the Inspector has been extended to twenty days. The vendor has the right to be present or to be represented at the taking of the sample, and if the Analyst's certificate shows that there is no discrepancy to the prejudice of the purchaser the vendor may claim from the purchaser his reasonable expenses in attending.

Miscellaneous.

The regulations prescribe limits of error within which the percentages of ingredients of fertilizers may differ from those shown in the vendor's invoice certificate. These limits of error are similar to those of the British regulations, but the former allow rather greater latitude. For most "straight" fertilizers an error of 1 per cent. in phosphoric acid, 0.5 per cent. in nitrogen, and 1 to 2 per cent. in potash is allowed.

The fineness of grinding is to be declared in the case of basic slag and ground rock phosphate, and the regulations prescribe that the standard of fineness through the standard sieve (No. 100 E, made by Amandus Kahl, of Hamburg) shall be 80 per cent. Owing to the necessity of installing special machinery to grind rock phosphate to this standard a fineness of 70 per cent. will be permitted until November, 1929. While the Amandus Kahl sieve has been the standard for basic slag for many years, the British-made sieve known as the 90 I.M.M. (Institute of Mining and Metallurgy) has been recently

tested and found to give practically identical results. This sieve may therefore be used with confidence, instead of the 100 E, where the latter is not readily available.

Where the percentage of phosphoric acid soluble in citric acid (citric solubility) is stated by the vendor, the solubility is to be estimated by the method prescribed in the regulations. By varying the proportions of fertilizer, citric acid, and water, widely-differing results can be obtained ; hence the need for a standardized procedure.

Every vendor should be in possession of the Fertilizers Act, 1927, and the regulations thereunder. The Act can be obtained (price 9d.) from the Government Printer, Wellington. The regulations are obtainable gratis from the Chief Chemist, Department of Agriculture, Wellington, and copies will shortly be distributed to all registered vendors.

WOOL RESEARCH.

DR. NICHOLLS'S PRELIMINARY REPORT ON NEW ZEALAND CONDITIONS.

DR. J. E. NICHOLLS, of Leeds, who has been travelling in New Zealand for two or three months in the course of an overseas mission of investigation on behalf of the Empire Marketing Board and the British Research Association for the Woollen and Worsted Industries, completed his itinerary at the end of March. A detailed report by Dr. Nicholls, including a discussion of the various breeds of sheep, will be made available later, after submission to the Board and the Association. In the meantime he has furnished the following general preliminary report to the New Zealand Wool Research Committee :-

Observations on Sheep-breeding and Wool-production in New Zealand.

Ample opportunities have been provided in the course of my itinerary for the careful study of conditions in the sheep-breeding districts, and of stud and commercial flocks of the various breeds ; and much interesting information has been obtained. For the purposes of this report certain aspects only will be mentioned.

It would appear that, from the point of view of the standard of the wool-clip of New Zealand, the considerations of greatest moment are those which affect the methods of fat-lamb production—the idea of which has dominated sheep-breeding practice for years. Further, it is probable that increase in sheep numbers will be due largely to increased carrying-capacities of existing sheep-country, and the development of that type of mixed farming in which cattle and sheep are associated in the management of dairy lands.

The problem of wool-improvement, therefore, must be closely invested by the study of sheep husbandry. It cannot be denied that much good would emerge from an educational policy whereby the farmers whose activities lie chiefly in the direction of fat-lamb production (in most cases from a form of "flying" ewe flock) would be encouraged to the use of better stock, better methods of selection, and better preparation of the clip for market. Such a policy could not, however, proceed far without the background of a greater knowledge of wool characters in so far as they constitute the fleece, which must be the unit in sheep-breeding for wool-production.

New Zealand would appear to be well suited to the conduct of sheep-breeding and wool investigations, for the following reasons :—

- (1) There are great variations and contrasts in natural environment within comparatively small areas.
- (2) There is a great range of sheep types.
- (3) The most important breeds, numerically, have rapidly spread over large areas and into a variety of environments, and are yet in a state of flux so far as type is concerned.
- (4) The wool product is of great value to the community.
- (5) Criticisms of the character of the clip have drawn the attention of breeders to a closer study of their wools.

Research into Problems of Wool-production.

The relation of raw material to its uses in manufacture must be borne in mind in order that defects present in the raw material may be reasonably weighted in their effects on manufacturing value. While all wools can be considered to possess certain defects or faults from the manufacturer's point of view, the breeder is interested in the distribution of such defects in his fleeces and the reasons for their presence. Hence it would appear desirable that close biological study be made of New Zealand fleeces, particular attention being devoted to those characters which are undesirable in manufacture. This would of necessity involve the closest possible co-operation with bodies of workers interested in the commercial utilization of wool products.

A few characters may be mentioned as examples: (1) Length and average diameter, and their distribution in the fleece; (2) variations in diameter and shape of individual fibres; (3) variations between neighbouring individual fibres throughout the fleece; (4) elasticity and strength of fibre; (5) softness of "handle"; (6) density of fleece, and the arrangement of follicles giving rise to different degrees and distribution of density; (7) staple formation—laterally and longitudinally—and crimp; (8) lustre; (9) the presence of intrusive fibres—*e.g.*, kemp; (10) the relation of fleece material to other skin-secretions. These characters cannot be considered as independent; indeed, it may be that the underlying principles of all wool research should be the consideration of the production of amount of fibre material and the character of that material as produced.

It would appear that the important fields to traverse are—

- (1) The general growth-rate of the fleece—in all dimensions—dependent upon the activity and distribution of the follicles, which is in turn based upon genetic and nutritional conditions.
- (2) The changes in fleece and fibre character with age and inclination to transitory changes in environment.

Within these fields would come, for example, the study of "thickened tip" and similar characters; the establishment of criteria of selection (more important in mutton or fat-lamb producing breeds where early selection of breeding-stocks is most desirable); and the study of the inheritance of fleece characters.

- (3) The study of the economic balance between wool and meat production.

The Mechanism of Research.

The precise means of the conduct of experimentation and research can be decided only according to facilities which can be provided within the Dominion; but from the broad point of view it would appear most desirable that a very close co-operation with other research bodies in the Empire, including an interchange of workers for training and subsequent experience, should be considered. This would eventually necessitate the establishment of some central organization within the Dominion from which research, fundamental and applied, on sheep-breeding problems could be conducted.

MOTTLING IN COLOURED CHEESE.

INVESTIGATION AT WALLACEVILLE.

G. F. V. MORGAN, N D.A., N.D.D., Dairy Bacteriologist, Wallaceville Laboratory.

A NUMBER of sample plugs of cheese have recently been examined by the writer for bacteria which might be responsible for the mottled and streaky appearance of several lines of coloured cheese received at some of the grading-stores this season. The examination has not revealed any organism that would be capable of producing the mottling effect in the pressed curd, either immediately after pressing or at a later date, but some interesting information has been acquired on other aspects of the problem.

In an experiment conducted in connection with openness in cheese, two loaf cheddars were made at a factory on the same day, and treated in the same manner. The first cheese was forwarded to the laboratory immediately after removal from the press. It was carefully packed and well wrapped in parchment paper, and arrived in good order. On arrival the cheese was cut in half from top to bottom. The cut surfaces revealed the usual types of openness, more particularly round the outside, and a very marked mottled appearance. The mottled appearance was much more pronounced in this cheese (directly after pressing) than in the plugs from the cheese received from the grading-stores. The mottling in the first instance followed the outline of the larger particles of curd as they had been pressed in the hoops, and showed a distinct milky-white area round each particle. On cutting the newly made cheese this moist white area was squeezed by the downward passage of the knife, and consequently some of it became smeared over the evenly coloured particles of curd. When the cut halves had been allowed to remain for a fortnight and were then cut into quarters the mottled appearance was still distinctly visible, but was typical of the plugs forwarded from the grading-stores, showing the somewhat faint but firm yellow brown mottling typical of the mature discoloured cheese.

The results of this experiment seem to point to the fact that mottling is due to the expressure of the white fatty whey after pressing, rather than during the last stage of cheddaring. The white moist discoloration that surrounded the particles of curd and became smeared across the newly cut surface of the cheese was identical with the white whey that is lost just before salting in a properly cheddared cheese.

This type of whey is very rich in fat, and also contains a large percentage of albumen and milk-sugar. These two latter constituents form an excellent medium for bacterial growth, which accounts for the fact that decomposition frequently begins in the mottled areas. Bacteria of the lactose fermenting type will work more rapidly in these areas, but if they are of the *Streptococcus lactis* type will do little harm, except perhaps to cause a slightly uneven ripening of the cheese. Putrefactive organisms, however, most of which are capable of breaking down casein, and a very large number of which will have escaped the pasteurization of the original milk, are likely to multiply rapidly in the discoloured areas and to use them as a base for attacking the protein in the better-drained portions of the cheese.

The damage done by these protein breakdown types of bacteria will be noticed much sooner in coloured cheese than in the plain white cheddar, as the colour contrasts when slow liquefaction of the protein is taking place will be greater, and therefore sooner apparent, though the same damage is probably being done in the white cheese. In ripe cheese the discoloured parts are often noticeable not only from their difference in colour, but by the fact that they are becoming spongy and slowly liquefying.

LIME-DEFICIENT AREAS IN KING-COUNTRY.*

TOP-DRESSING EXPERIMENTS WITH SHEEP AT MAIROA.

C. M. WRIGHT, Country Analyst, Mineral Content of Pastures Investigation.

THE object of conducting the field experiments at Mairoa as here described was to demonstrate the behaviour of sheep of various ages on paddocks top-dressed with lime alone, and with a lime and super-phosphate mixture containing a great deal more lime than the usual basic super, which had not proved satisfactory previously.

The sheep used for the experiments were bred locally, and were selected as being of the type with which most of the so-called "dopiness" was experienced. No attempt was made to select sheep of even weight or type for each experiment, the idea being to use sheep known to be troublesome to rear and hold, and also to make the results of value for practical purposes both from the points of view of the farmers and the mortgagees; it was specially necessary that they should have confidence in the results.

As it is often a matter of opinion as to how stock are doing and have done when the appearance of them is the only evidence, it was decided that the sheep should be weighed at intervals as regularly as possible, so that the response of each animal would be known. For this purpose numbered metal tags were inserted in the ear. It was found when the weighings were first commenced that it would be necessary to shed the sheep overnight before weighing, so as to have them empty. It is impossible to get constant weights with sheep off pasture, as apparently they have varying capacities, depending on the time of the day, the weather, and their general health.

For weighing-purposes a sack was split down one side and tied at both ends, and the sheep laid on its back on the sack, which was then hooked on to a spring balance. It was found that there was very little struggling on the part of the animal when this method was used, and the weight and number were easily ascertained.

It was also found early in the experiments that most of the bad-doers were infected with internal parasites, and that it was imperative they should be treated for that trouble. It should be clearly understood that this must be done in all cases where the appearance of the animal indicates the presence of parasitic infection; it is not fair

* Useful reference may be made to an introductory article on this subject, entitled "Mineral Content of Pastures: Lime-deficient Areas and a hitherto Unsuspected Malnutrition Disease in Sheep," by B. C. Aston, published in the *Journal* for September, 1928.—*Ed.*

either to the animal or to the malnutrition treatment to expect the latter to effect a spectacular cure and so build up the animal in a short time that the effects of the parasites are nullified. What will very probably happen will be that the animal will be in such a poor state of health that before the more healthy and normal pasture can be effective the parasites will win and the animal die, and the pasture or other treatment will then be condemned as a failure.

The treatment for parasites now being used is to dose the animals with a solution of copper sulphate to which mustard is added (they had previously been dosed with a proprietary arsenical preparation). For this purpose $\frac{1}{4}$ lb. of fresh bright copper-sulphate crystals is dissolved in some heated water in a jar, the solution is made up to 3 gallons (preferably in an earthenware jar), and a paste of $\frac{1}{4}$ lb. of mustard mixed with water is stirred in. For a grown sheep 3 oz. of the solution is given, and for a lamb $\frac{1}{2}$ oz. to 1 oz., according to age. Where the sheep are badly infested and the source difficult to remove it will be necessary to dose animals showing signs of infestation once every four weeks. Small metal containers suitable for the drenching may be purchased from ironmongers.

FIRST GROUP OF EXPERIMENTS.

The first group of experiments—lime alone, gypsum, and control—are situated on a high part of the Mairoa district (about 1,200 ft.) and are on country with a "lime-requirement" of about 10 tons carbonate of lime per acre. A 20-acre paddock typical of the affected country and in a central position was fenced, and 38 tons of ground limestone spread on it. This spreading was finished at the end of the first week in January, 1928. and after good rains forty lambs were put on the paddock.

The first weighing was on 24th April, 1928. Six lambs were drenched for parasites on two occasions each, and one on one occasion, during the twelve months. This treatment seemed to be required only at the end of the past year, and may be due to the sheep being on dry pasture and drinking from waterholes that had become stagnant owing to the dry weather. Samples of wool were taken for examination and the weights of the fleeces noted.

In July the paddock was cut into two, so as to give the sheep a change of pasture. In addition to the forty lambs, which had no supplementary feed of any sort, four young cattle were grazing on the paddock till the end of the winter. There does not seem to be any doubt that the carrying-capacity has been improved. Before the top-dressing the pasture was a worn-out one consisting mainly of danthonia, fog, and a little Lotus major, and was badly infested with pipiriri and moss; white clover could not be found. Now, at time of writing, after fifteen months, there is a better general colour, cocksfoot, rye-grass, crested dogstail, and white clover are showing up. There is also a rather remarkable feature in that earthworms have made their appearance in numbers, whereas they are very difficult to find on the unlimed country. The worms were first noticed three months after the lime had been applied. About 5 acres has been roughly logged up and burnt, and will be harrowed and sown with fresh grass-seed to see if it is possible to improve the pasture on the easier parts of the country by this method.

Table 1.—Weights of Sheep in Pounds on Limed Paddock (First Group).

No.	24/4/28	11/5/28.	4/7/28.	24/8/28.	2/10/28.	6/11/28.	26/11/28.	Wool, 26/11/28.	10/1/29.	11/2/29.	Dosing.	Total Gain.	Total Gain, plus Wool.
24 (w) ..	57	58	60	57	58	60	62	5½	55	51	pp	-6	-½
25 (w) ..	46	44	45	46	41	49	52	4	49	47	pp	1	5
26 (e) ..	43	46	49	43	53	51	61	4½	64	74	..	31	35½
27 (e) ..	48	47	49	48	48	53	58	4	61	64	p	16	20
28 (e) ..	53	52	54	53	53	60	56	3	72	82	..	29	32
29 (e) ..	46	55	56	46	50	59	56	5	70	81	..	35	40
30 (e) ..	55	58	58	55	58	66	61	6	80	90	..	35	41
31 (e) ..	48	50	51	52*	56	64	62	6½	74	78	..	30	36½
32 (w) ..	45	48	51	45	50	59	56	3½	71	81	..	26	29½
66 (e) ..	53	55	55	53	57	63	68	5	71	81	..	28	33
34 (w) ..	56	59	58	56	58	63	60	4	75	80	..	24	28
35 (e) ..	55	57	59	55	59	59	66	5½	75	86	..	31	36½
36 (e) ..	50	50	53	50	52	52	57	5	57	66	..	16	21
37 (e) ..	42	41	51	42	48	53	50	5	65	75	..	32	37
38 (e) ..	53	56	58	53	57	65	65	4½	76	81	..	28	32½
39 (e) ..	59	53	59	59	62	66	67	4½	67	74	..	15	19½
40 (w) ..	56	58	54	56	62	71	68	4½	83	91	..	35	39½
41 (e) ..	58	57	59	58	50	55	62	4	69	77	..	19	23
42 (w) ..	49	56	60	49	52	60	56	6	70	77	..	28	34
43 (w) ..	57	60	61	57	50	60	54	3½	62	61	pp	4	7½
44 (e) ..	45	52	53	55*	60	67	64	4½	79	89	..	44	48½
45 (w) ..	52	53	57	53*	54	65	59	5	73	77	..	25	30
46 (w) ..	67	60	63	67	72	81	83	5	87	96	..	29	34
47 (w) ..	60	64	61	60	61	64	72	5½	76	91	..	31	36½
48 (w) ..	53	56	57	53	56	61	62	4	76	85	..	32	36
65 (e) ..	49	54	53	49	54	49	54	4½	55	63	pp	14	18½
50 (w) ..	38	37	37	38	42	45	47	3	55	56	p	18	21
51 (e) ..	41	42	44	..	..	..	..	..	..	..	..	..	..
52 (w) ..	55	54	56	55	51	53	62	3½	60	74	pp	19	22½
67 (w) ..	47	55	57	57*	58	54	62	5	64	77	..	30	35
54 (w) ..	52	57	57	52	57	64	68	5	71	81	..	29	34
55 (w) ..	58	60	62	58	58	66	64	5	78	90	..	32	37
56 (e) ..	52	47	47	47†	53	60	55	5	69	77	..	25	30
57 (w) ..	61	62	61	61	63	70	66	5½	80	91	..	30	35½
58 (e) ..	46	50	58	46	49	54	59	4	67	77	..	31	35
59 (e) ..	55	60	56	55	57	65	59	6	76	86	..	31	37
60 (w) ..	44	43	45	44	51	54	59	4	62	70	pp	26	30
61 (w) ..	48	47	47	48	..	..	..	..	..	..	..	..	..
62 (w) ..	52	47	51	55*	52	57	58	4½	69	79	..	27	31½
63 (e) ..	66	72	67	66	71	78	74	7	92	103	..	37	44

w = wether; e = ewe; p = dosed for parasite 2/2/29; pp = dosed 2/2/29 and 10/1/29; * = increase; † = decrease.

Average total increase: Ewes, 27·7 lb.; wethers, 23·4 lb. Average weight of wool: Ewes, 4·8 lb.; wethers, 4·3 lb.

It will be noticed that after the fourth weighing only five sheep showed an increase, while one (No. 56) showed a decrease. At this time the paddock was halved and the sheep had a shift, which shows in the weights, only three being lower at the next weighing. Nos. 24, 25, and 43, all wethers, do not show satisfactory increases. No. 63 is now the heaviest sheep of that age in the experimental paddocks.

Table 2.—Weights of Sheep on Gypsum-dressed Paddock (First Group).

Number.	6/11/28.	26/11/28.	10/1/29	11/2/29.	Wool (26/11/28).
68 (w) ..	61	66	69	80	4½
69 (w) ..	70	78	79	87	6
70 (e) ..	62	67	67	81	4½
71 (e) ..	64	71	72	84	7½
72 (e) ..	67	74	84	96	6
73 (e) ..	64	71	75	85	5½
74 (e) ..	73	83	86	96	8
75 (w) ..	67	75	85	98	5

Average increase in weight: Ewes, 22.4 lb.; wethers, 22.3 lb. Average weight of wool: Ewes, 6.3 lb.; wethers, 5.2 lb.

It will be seen that in no case was there a decrease in weight, though No. 70 did not increase in six weeks.

Table 3.—Weights of Sheep on Control Paddock (First Group).

Number.	6/11/28.	26/11/28.	10/1/29.	11/2/29.	Wool (26/11/28).
76 (e) ..	62	67	71	80	5½
77 (w) ..	74	80	84	88	4
78 (e) ..	53	58	59	64	5
79 (w) ..	71	72	82	89	5
80 (w) ..	66	70	76	85	4
81 (e) ..	55	58	48	47	4½*
82 (w) ..	67	71	78	89	6
97 (w) ..	70	76	83	91	5
84 (e) ..	64	70	74	82	5½
85 (w) ..	71	77	76	85	6

* Drenched 10/1/29 and 2/2/29.

Average gain in weight: Ewes, 9.75 lb.; wethers, 19.7 lb. Average weight of wool: Ewes, 5.1 lb.; wethers, 5.0 lb. (The apparent disparity in the respective gains of ewes and wethers is due to the loss of 8 lb. by one of the four ewes. Actually, with this one exception, the ewes did as well as the wethers.)

The sheep on the gypsum and control paddocks were wintered on turnips, and were of a better type than the sheep on the limed paddock, thus having a great advantage. All of this group of experiments are being conducted on one farm and the paddocks are adjacent to one another. Arrangements are being made to increase the size of the gypsum and control paddocks, so that the number of sheep on them may be increased and thus give more reliable results. The owner of the sheep has generously agreed to allow them to remain on the experimental areas for another year. This and the gypsum-dressed paddock will be doubled in area for next season's experiment.

It will be noted that the experiment on the limed paddock covered a period of ten months, whereas those on the control and gypsum paddocks had been in progress for only three months. These latter are therefore not strictly comparable with the limed paddock.

SECOND GROUP.

Another area was selected about three miles away from the first group, and 13 tons of ground limestone were spread on about 9 acres.

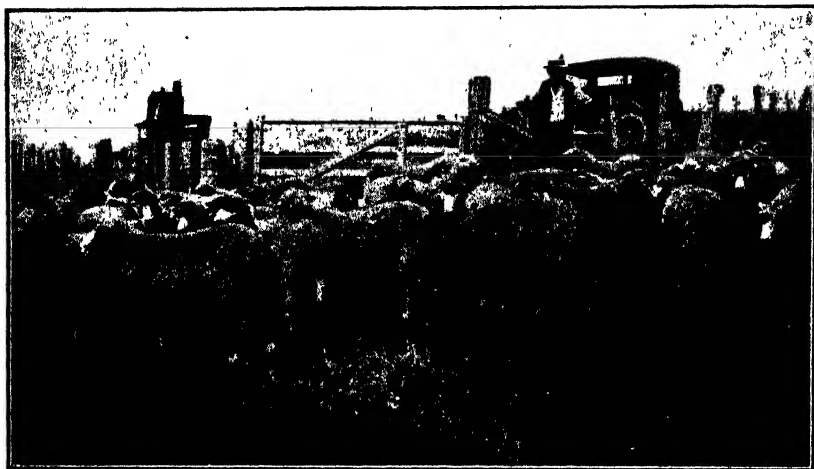


FIG. 1. HOGGETS AFTER A YEAR'S GRAZING ON LIMED PADDOCK (SOLE DRESSING) AT NAPIENGA, MAIROA—SEEN IN PERFECT HEALTH.



FIG. 2. EWES AND LAMBS ON LIMED PADDOCK (SOLE DRESSING) AT MAIROA VILLAGE, AFTER A YEAR'S GRAZING.

The condition of these animals speaks for itself.

[Photos by B. C. Aston.]

Ten ewes, from two-tooth up to six years old, having been specially selected as being unsuitable for breeding-purposes and not likely to survive, were put on this paddock. No. 18 was so weak that it was only with difficulty that she could walk to the pen for weighing. It was decided that no control would be necessary in this case, as the sheep were a class on their own, and that bringing them through the year would be a sufficiently severe test. It was also decided to keep

the ewes dry, but seven of them accidentally got in lamb and lambled normally in due course. These lambs were numbered and weighed and will be placed on a limed paddock for further observation. The fact that the ewes gave such a good increase in weight and that the lambs did so well, as indicated by the tables, is looked on as quite a satisfactory result.

Table 4.—Weights of Ewes on Limed Paddock (Second Group).

Number.	10/5/28.	4/7/28.	23/8/28.	2/10/28.	2/11/28.	1/12/28.	Wool.	11/1/29.	12/2/29.	Age, in Years.
13	71	87	94	90	90	95	5½	100	103	5
14	78	83	86	96	101	103	5½	108	109	4
98	78	85	93	109	98	100	5	99	100	3
16	85	100	106	125	114	116	4½	116	118	6
17	113	117	121	138	120	118	5	113	109	5
18*	61	68	82	83	88	94	5	99	102	3
19*	80	91	94	113	119	132	6	135	139	6
20	91	103	96	93	92	91	5½	96	96	6
21*	55	57	61	72	78	81	6½	84	88	2
22*	66	75	81	99	113	86	6½	88	93	3
23	54	67	72	93	84	84	4	92	98	2

* Dry ewe

Table 5—Weights of Lambs from Seven Ewes in Table 4 (Second Group).

Number	Wool	21/12/28.	11/1/29	12/2/29	No. of Dam
1 (c)	1	52	50	69	16
2 (w)	1	48	53	65	23
3 (c)	4	71	69	78	20
4 (c)	3	67	62	70	13
5 (w)	1½	50	53	62	17
6 (c)	1	50	55	68	98
7 (e)	1½	48	47	54	14

Arrangements have been made to keep these lambs on a limed paddock, and they will be weighed and watched as part of the experiments. A further area of 5 acres has been limed and will be included in the limed paddock for next season's experiment.

A further experiment on this farm was one in which 25 acres of country that had reverted to fern badly in parts was top-dressed with 5 cwt. of ground limestone and 2 cwt. of super per acre. The fern, where it was possible to do so, was similarly treated. The paddock was fenced and stocked with cattle and sheep, which had the run of a larger area as well. The stock worked the paddock well, and the fern is now (at the end of six months) practically all dead and the grass looking very healthy. On this farm last year approximately thirty wethers were sold fat, while this year 130 fat wethers have been sold at top price, most of them coming off the top-dressed paddock. It is hoped to have a weighing experiment on this paddock in the present season.

GENERAL.

A rain-gauge was installed locally during the year and the monthly records to the end of February were as follows :—

					Total Fall in Inches.	Number of Wet Days.
August ..	..	..	..	..	7.22	22
September ..	..	..	..	..	19.36	24
October ..	..	..	..	..	10.18	22
November ..	..	..	..	..	4.52	16
December ..	..	..	..	..	6.40	16
January ..	..	..	..	..	2.39	13
February ..	..	..	..	..	2.10	5

The carrying-out of these experiments has involved 700 weighings of sheep. In addition, 105 samples of pasture and seventy-four samples of wool have been collected and forwarded to the Agriculture Department's Chemical Laboratory at Wellington.

Experimental work in the administration of mineral supplementary rations by the pellet method has been commenced locally, and will be the subject of a later report.

WEEDS AND THEIR IDENTIFICATION.

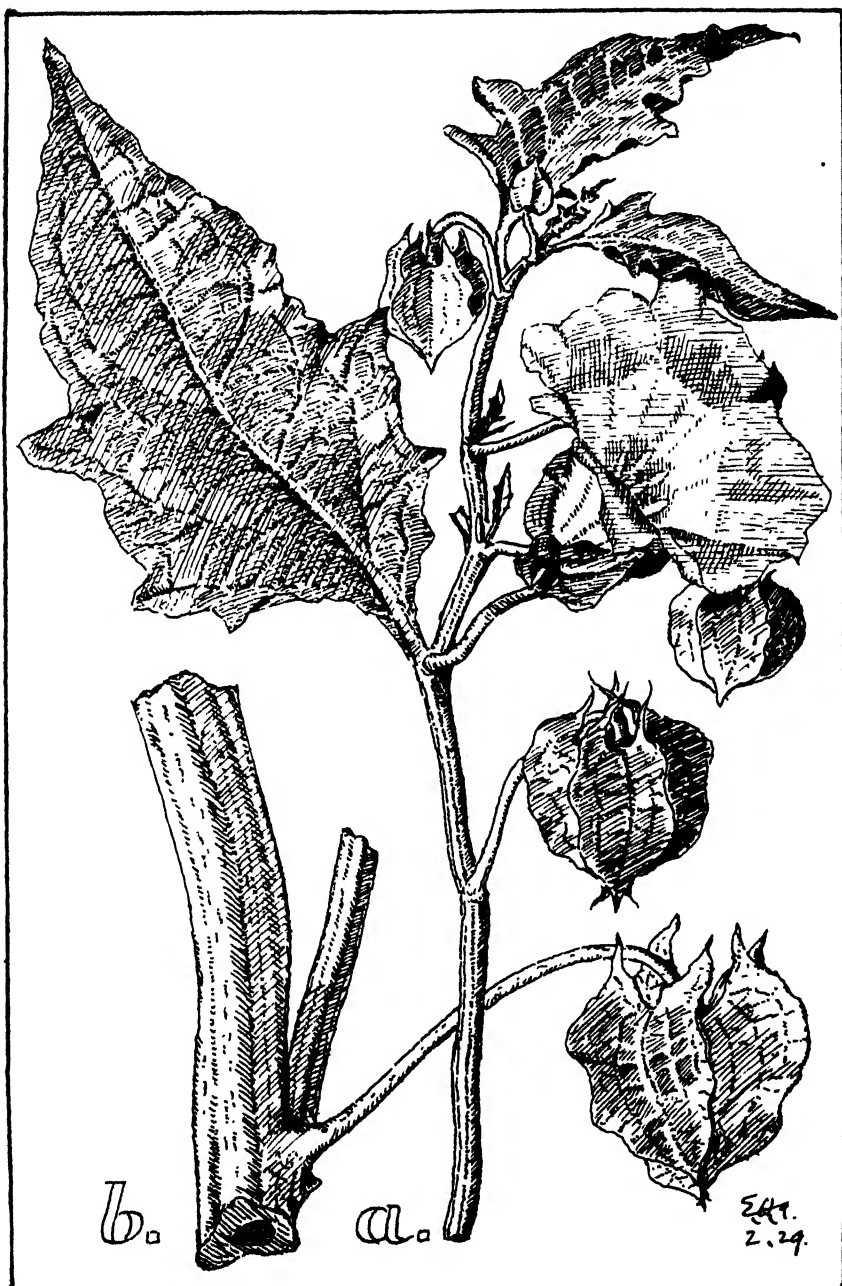
APPLE OF PERU (*NICANDRA PHYSALOIDES*).

ESMOND ATKINSON, Department of Agriculture, Wellington.

APPLE OF PERU is not scheduled in the Noxious Weeds Act, nor is it a plant which is likely to be found in lists of bad weeds, as it is an annual with an unaggressive root-system. Where it is established, however, it is so conspicuous, and, furthermore, shows such curious points of likeness and of difference when compared with Cape gooseberry (*Physalis peruviana*), that it is just one of those plants about which questions are always being asked.

Cape gooseberry is very well known in New Zealand, but is really naturalized in only a few places; it is generally found as an "escape from cultivation"—the name given to a plant that can continue to exist and to reproduce itself near where it has been grown, but which spreads very slightly and is not capable of making itself at home as a unit of the vegetation. Apple of Peru is definitely naturalized, though only within certain narrow limits, being generally described as a weed of roadsides and waste places. From the practical farmer's point of view such a plant is not a "weed" at all, and now seems an appropriate time to emphasize again the primary object of these articles—to help those who are interested to find out the names of the many wild plants (introduced and native) that occur within settled areas, quite apart from their immediate importance as agricultural weeds.

There is no confusing these two closely related plants when they are in flower—the lavender-blue and white of *Nicandra* being different enough from the pale yellow and deep purple (almost black) of the

APPLE OF PERU (*NICANDRA PHYSALOIDES*).

(a) Leafy shoot with buds, a flower, and young fruit; (b) part of stem near base, with a ripe fruit. All natural size.

[Drawing by Esmond Atkinson.]

other. The fruits are much alike, though, and the following key is given to show the technical differences:—

Calyx inflated after flowering—

Calyx 5-partite, cordate at base	<i>Nicandra physaloides.</i>
Calyx shortly 5-lobed	<i>Physalis peruviana.</i>

This may be translated to mean that the cover of the berry in the case of apple of Peru is made up of five separate lobes or divisions that extend backwards beyond where the stalk is joined on to them, so that when the whole fruit is seen from the side it has a heart-shaped or cordate appearance (see illustration). In Cape gooseberry the five lobes are joined together for most of their length (they spread a little at the tips), and they end where they meet the stalk and do not extend backwards to form a heart-shaped base. The juicy yellow berry of Cape gooseberry is replaced by a smaller dull-coloured dry one in the apple of Peru.

Nicandra physaloides is a strongly growing, smooth, and hairless annual, 3 ft. or 4 ft. high, a single plant occupying about 1 square yard of ground. In the illustration (b) is shown a bit of the lower part of the stem, which is nearly 1 in. thick in a big plant, variously angled and ribbed, and hollow in the middle. The shape and size of the leaves are shown at (a). They are green and smooth, and not velvety to the touch like those of Cape gooseberry. The drawing also shows the different stages of development of the bud, and an open flower. Because of the size and unusual colour of the flower apple of Peru has been grown in gardens, but the flowers only open a few at a time and in bright sunlight, so the plant has never become popular. The fruit need not be described in detail; another likeness to Cape gooseberry is in the covering of the berry becoming finally quite dry and straw-coloured.

Nicandra and *Physalis* belong to the big family *Solanaceae*, which includes the potato, tobacco, and tomato, and such plants as the various kinds of deadly nightshade, &c., so well known as weeds. Apple of Peru is a native of South America, and was first recorded here early in this century. It is now found in many parts of the North Island, and as far south as Canterbury in the South Island.

CO-OPERATION IN CREAM COLLECTION.

A SUBJECT worthy of more consideration is the collection of cream in those districts where home separation is in existence, and where more than one dairy company is operating over the same area. The question of quality as well as of transport costs is involved. There would appear to be room for a number of our companies in certain districts forming a co-operative concern of their own for the transport of the cream within their territory, or conjointly making a contract for the transport of such cream. This should reduce costs, and be in the interests of larger pay-out to the suppliers. It should also have a beneficial effect on quality in some districts by way of making more frequent deliveries possible. It seems rather short-sighted policy for dairy companies to work independently in this respect when combined action would be to the monetary advantage of all concerned. It might also be good business for some companies to reduce the territory from which they seek to draw their supplies, and concentrate effort on reduced collection costs. More dairying development near the factory and better quality should be possible through attention to these matters.—*Dairy Division.*

SHELTER-BELTS FOR THE FARM.

(Extracts from State Forest Service Circular No. 25.)

EFFECT OF SHELTER-BELT UPON AIR-CURRENTS.

A SUMMARY of statistics available from experiments carried out in various countries to ascertain the efficiency of shelter-belts in subduing the velocity of wind and preventing the damage to crops shows that a shelter-belt 66 ft. in height will afford protection for a distance of 5 chains (or five times its height), and partial protection for a distance of 15 chains (fifteen times the height); even then the wind-current will not have regained its initial velocity. On the windward side of the "break" there is also a diminution of force for a considerable distance back owing to the disruption of the air-current caused by the rebound and uplift of the lower strata of air. (Diagram 1.)

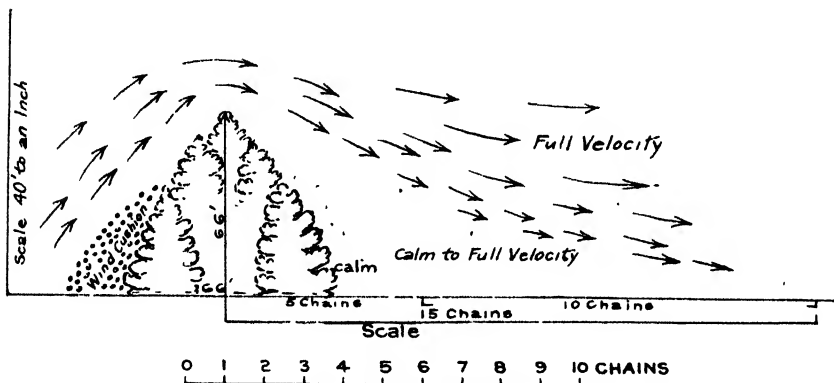


DIAGRAM 1 —EFFECT OF SHELTER-BELT UPON AIR-CURRENTS.

ASPECT AND RESULTANT SHADE FROM SHELTER-BELTS.

The direction of shelter-belts should, if possible, be north and south, so that a minimum of shade will be incurred, and, in addition, the two most troublesome winds north-west and south-west are diverted from the crop. In Diagram 2 the cone represents a series of shelter-belts from 30 ft. to 100 ft. in height, running north and south, the season of the year being midwinter. As an example of how to read this diagram, take a shelter-belt of trees 60 ft. high; it is found that the eastern paddock will be in full sun from sunrise until 12.58 p.m. and the western paddock from 11.20 a.m. until sunset. This demonstrates clearly that no part of either paddock is seriously affected by shade.

Diagram 3 shows a five-row belt of uniform height, the shadows of which are thrown 20 ft. farther out than is the case when the species are graded according to height. This is an additional advantage secured by the shelter-belt with a "conical outline."

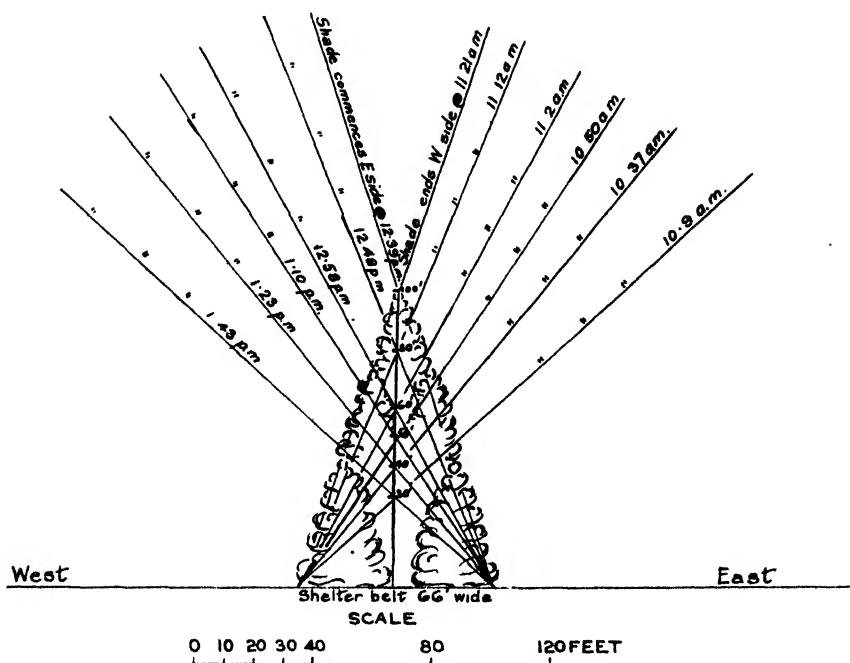


DIAGRAM 2.—CROSS-SECTION. SHELTER-BELT RUNNING NORTH AND SOUTH.
(Midwinter in Canterbury, Lat. $43\frac{1}{2}^{\circ}$ S.)

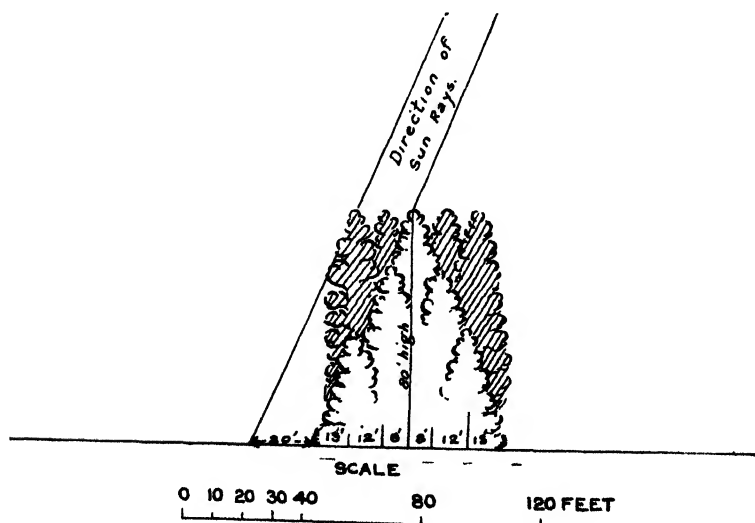


DIAGRAM 3.—CROSS-SECTION OF SHELTER, SHOWING ADVANTAGE OF CONICAL OUTLINE.

A shelter-belt running east and west is of comparatively little practical value, and does actual harm by the long shadows cast in winter. Diagram 4 shows a section of a belt running east and west, and illustrates the length of shadows thrown at the latitudes of Auckland, Canterbury, and Southland. For example, even in North Auckland the shade cast by an 80 ft. belt will extend 136 ft. Furthermore, east-and-west shelter-belts are no protection against the north-west and south-west winds.

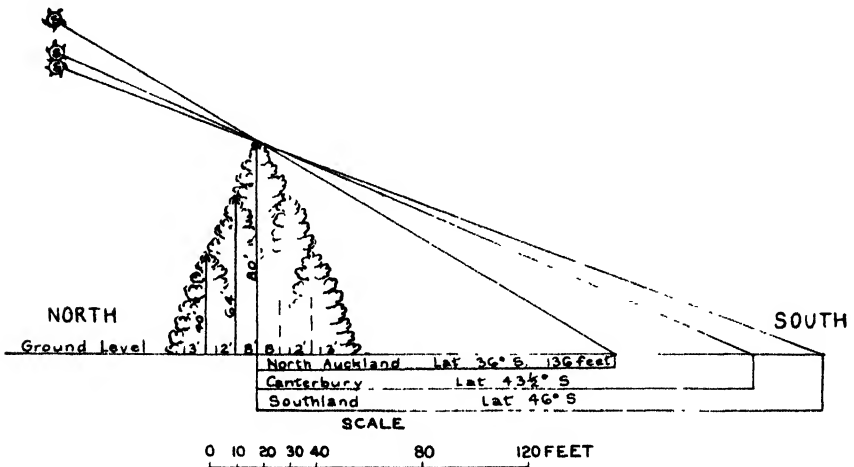


DIAGRAM 4—SHADE CAST BY SHELTER-BELT RUNNING EAST AND WEST.
(Midday sun, midwinter.)

THE SHEEP LEG-LOUSE.

A SPECIES of louse on sheep which is not frequently seen, and on account of this is often not recognized by farmers, is one affecting the hairy portion of the leg and known technically as *Hæmatopinus pedalis*. The parasite infests both the fore and hind limbs, but more frequently is seen on the hind legs. It is a blood-sucker, and lays a large number of eggs which remain attached to the hair, giving the affected part a distinct brown appearance. The parasite first made its appearance, so far as is known, in the Banks Peninsula district. Since then it has appeared in various parts of the North Island, also in the Nelson District. In a case which came under notice last year the wool of a ram's scrotum was found to be densely infested, while the scrotum itself was considerably enlarged and hardened.

The leg-louse can be readily detected at shearing or crutching time. Ordinary dipping methods are effectual in dealing with the vermin, and as clean sheep may become infested by contact with affected animals immediate precautions should be taken to safeguard the flock directly its presence has been detected.

—*Live-stock Division.*

SEASONAL NOTES.

THE FARM.

ROTATIONAL GRAZING ON DAIRY-FARMS.

MAY marks the end of the main milking season, and now is a good time to make plans for next season's work. Many farmers are at present turning their attention to schemes of intensive grass-farming and the adoption of rotational grazing practices. The general principles underlying the practice of rotational grazing are now fairly well known. Briefly the system consists in the close subdivision of the grassland, regulated stocking, and heavy and complete manuring. Grass is treated as a crop, the pasture being allowed to reach a length of 3 in. to 5 in., quickly grazed down, and then spelled till the next crop of young grass is ready.

It is not possible at the present time to give any very definite information outlining a complete scheme for rotational grazing, for the experimental work conducted by the Fields Division this season has rather emphasized difficulties to be overcome than provided a system to be widely adopted. A certain amount of data, however, has been already collected bearing on the size of subdivisions and the intensive use of fertilizers that is of interest to farmers, and further notes will be published as the results of the season's work become available.

The first important point to be decided when adopting the system is the plan of subdivision and the size of the fields. Wherever possible the farm should be subdivided on the plan of a central race upon which all fields open. The race should not be narrow, as cows going to and from the milking-shed churn up a narrow race badly during wet weather. A width of 1 to $1\frac{1}{2}$ chains is much more satisfactory than a race $\frac{1}{2}$ chain wide. A wide race can be grazed and managed as an ordinary field. In most cases, however, there is no necessity to reorganize the whole internal fencing of the farm, and the subdivision of existing fields is all that is necessary. The size of the fields is determined by the rate of stocking, and it appears that the fields used for rotational grazing should be stocked at the rate of twelve to fifteen cows per acre at short intervals. A good even grass-growth of 3 in. to 4 in. in height will give two grazing-days of twenty-four hours each for twelve to fifteen cows per acre; for herds of twenty-two to twenty-five cows fields 2 acres, and for herds of thirty-five to thirty-eight cows 3-acre fields are satisfactory. Experimental work this season has shown that when stocking at the above rate the subdivision of 6-acre fields into two 3-acre fields meant the gain of a day's grazing. Before subdivision 6-acre fields were giving three days' grazing for thirty-seven cows, and when subdivided each 3-acre field gave two days' grazing for the herd. It is best to commence a scheme of rotational grazing gradually, making four or five small fields for a start, and treating the pasture on these fields as well as possible. It is unwise to enter on an extensive

scheme of rotational grazing until experience has been gained of the proper management of grassland under the intensive system of grass-farming. Also the practical difficulty of providing a continuous supply of feed, owing to the variation in the recovery period of pastures at different periods of the year, has not been completely solved at the present time. Some large fields which contain some rank feed are a good standby for grazing the herd during short drouthy periods in the late spring and summer. This difficulty will probably be got over, but whether the feed thrown by the rotationally grazed fields during short dry spells—which may occur at any time in the spring, summer, and autumn—should be supplemented by partially rank growth on some reserve fields, by rank grass-growth and concentrates, by grass ensilage, or grass ensilage and concentrates, can only be solved by further experimental work.

One of the most marked features of the current experimental work on rotational grazing is the very high per-acre production of butterfat from rotationally grazed fields. During the first half of this season such fields have produced 150 lb. to 200 lb. of butterfat per acre, and this is far higher than the average production from the whole farm will be for the season. A considerable amount of experimental work, however, will have to be performed before a suitable grazing and supplementary feeding technique is evolved to enable dairy cows to convert all the spring, summer, and autumn production of grass (except that required for hay and ensilage for supplementary feeding) into butterfat.

With regard to manuring of the rotationally grazed fields, this season's experimental work has so far shown that late winter applications of nitrogen to heavily phosphated grassland have given appreciable increases in the early spring production of grass. The economics of these late winter applications of nitrogen are now being studied, and should the practice prove payable it will provide a means whereby the dairy-farmer can supply young protein-rich grass for early-calving cows.

TILLAGE OPERATIONS.

Teams will be busy during May and June sowing autumn and winter cereals. During any periods when the weather is not suitable for sowing or cultivating, and yet the soil not too wet to plough, a start should be made on turning over any vacant land intended for winter fallowing. In the sub-humid, arable farming districts of the South Island summer-sown root and forage crops usually follow a cereal, and the stubble land should be ploughed in the late autumn or early winter, and left in the unbroken furrow-slices, so that the weathering agencies may have free play in breaking up clods, and in order to allow the winter rains to quickly pass through the top soil and enter the subsoil instead of running off the surface.

Root crops require enormous quantities of water; a 30-ton crop of mangolds, for instance, consumes about 1,500 tons. An inch of rain amounts to 100 tons per acre, so that at the yield stated 15 in. of rain would be required for the crop. The rainfall over a

large part of the arable farming districts of Canterbury is about 25 in., and the normal rainfall from October to April is 14 in., which is insufficient for the crop, as only about one-third of the summer rains percolate through the soil, the rest being lost by evaporation. The root crops must thus draw upon the reserves of water held in the soil and subsoil. The months during which a large proportion of the rainfall may be stored in the subsoil are May to September, so that late autumn and early winter ploughing is essential for the production of good root crops.

WINTER FEEDING OF YOUNG DAIRY CATTLE.

The first winter is a critical period in the life of young dairy cattle, and their subsequent development depends very largely on the feeding during this period. Calves should be the first stock on dairy-farms to be given a ration of hay in the early winter. It is essential to get them used to hay and root feeding before the grass-growth seriously declines, because it is usually some time before calves will eat much hay, and if its feeding is left too late the animals will often lose condition which they will not pick up again. Besides adequate food, the calves should get an ample supply of pure water; dirty drinking-holes in drains are liable to lead to the young animals becoming affected with internal parasites.

— P. W. Smallfield, *Fields Superintendent, Auckland.*

THE ORCHARD.

LATE HARVESTING.

THE work of harvesting the fruit crop is now nearing completion, Dougherty being the main variety still to be dealt with. Most of the fruit intended for cool-store, with the exception of that variety, should be in store by the end of April. Coloured varieties of apples are frequently in demand late in the year, and to store a small quantity of well-coloured Dougherty is sometimes advisable. These should be in store by the middle of May. Small Sturmers and Sturmers from the lower part of the tree, left to swell or to mature after the main pickings have been made, should not be allowed to remain on the trees too long, as frequently they become badly disfigured by the development of the characteristic small red spots caused by the fungus disease known as apple-spot.

THE AUTUMN CLEAN-UP.

The time immediately following the completion of the fruit harvest is opportune for a general clean-up of the orchard and packing-shed prior to beginning winter operations. Cases used for picking may be repaired and stacked away in readiness for the next season. Props gathered from the orchard may also be stacked, and if taken care of in this way they will serve for several seasons, even if they be of soft wood. Diseased and rotting fruit about the

packing-shed should be buried deeply, and the mummified remains of stone-fruit affected with brown-rot which may have been left on the ground during the rush of harvesting should also be gathered and destroyed or buried deeply. Trees affected with silver-leaf should be destroyed while they are easily distinguishable from healthy trees. Once the foliage is off they may be easily overlooked. Similarly, fireblight infections—some of which may hold over to spread the disease in the following spring—should be searched for and cut out now while they are more readily located. A premature autumning of the leaves on portions of pear-trees should be investigated, as this often leads to the discovery of a fireblight canker lower down the limb or branch.

DRAINAGE.

Open drains require cleaning out and putting in order before the winter; and outlets to tile drains clearing to allow of a free flow. Provision should be made for diverting surface water into open drains, or leading it off any portion of the orchard where such surface water is likely to gather. New drains to tap wet parts, especially in heavy retentive soils, should be opened up and tiles laid. It is not an economy to neglect drainage and find later that trees which should be coming into a productive state suddenly go into a decline through sour-sap caused by lack of drainage. Underground water such as springs or seepage may be disposed of by pipes, placing them at such a depth as to prevent the water rising above a certain level—say, 3 ft. from the surface. Rainfall on a retentive subsoil may also be disposed of by pipes, but ready access from the surface to the pipes is necessary. Pipes should therefore be covered by clean rubble or scrub, and subsoil dug out should not be placed back, as it would tend to seal the drain. Surface-water drains should be laid well below the loose surface-soil, and all drains should have a slight fall in every portion, otherwise silting up will occur in hollows.

CULTIVATION AND MANURING.

It is advisable, especially on heavy land, to turn the soil over now, so as to secure the full benefit of winter rains and frost for bringing it into a good tilth early in the summer. The orchard should be ploughed with the slope to facilitate surface drainage, ploughing up to the trees, and leaving an open furrow in the middle of the lands. Land intended for orchard extension should also be deeply ploughed now to ensure the ground being in good order for planting in the spring.

Most soils require periodical limings, and a dressing of up to 1 ton per acre may be applied now. Inorganic manures such as blood-and-bone may also be applied now, but the use of the quicker-acting fertilizers may best be deferred till nearer the spring movement.

NEW PLANTINGS AND WINDBREAKS.

Preparation for new plantings should be put in hand early. Already a decision should have been made as to varieties, and arrangements for a supply of trees. For commercial plantings the

choice of suitable varieties is limited, particularly with apples and pears. Varieties chosen should be chiefly those most suitable for export, as these are also suitable for local markets. However, the list may be supplemented with an early cooking and an early dessert variety for local requirements. Whether it is pip-fruit or stone-fruit being planted, or both, care should be taken to secure a succession, in order that the work of harvesting may be spread over the whole season.

Land should be put into thoroughly good condition before planting, and consideration given to shelter-belts, drainage, and general lay-out. The distance for planting is an important consideration, as hitherto the space between trees on rich land has generally been quite inadequate, especially for pears and stone-fruit. On some of the better class of land used for orchard purposes 25 ft. will prove a more suitable distance between trees for this class of fruit. It is inadvisable to plant large blocks of one variety without breaks. Plantings should therefore be so arranged as to limit the number of rows to five or six. Ample space should be left between fences or hedges and the nearest rows of trees in order to allow of easy turning with horses. Most planting is done in the spring as soon as the land is in a suitable condition for working. However, autumn planting may be resorted to in dry warm soils and if matured trees are available. This work may be done during May.

Windbreaks are a necessity in almost every locality, and should be planted as early as the setting-out of a new orchard. Shelter-belts to existing orchards require frequent topping, as to have an orchard too enclosed renders disease-control more difficult.

SPRAYING OF STONE-FRUIT.

An autumn application to stone-fruit trees of a bordeaux spray, 6-5-50, may be made for the purpose of better controlling such diseases as leaf-curl and die-back. Such an application has proved beneficial on some of the varieties of peaches notoriously prone to leaf-curl.

—N. J. Adamson, Orchard Instructor, Hastings.

Citrus-culture.

New Plantings and Extensions.—Where it is intended to plant during the coming season, preparation of the land right away is advisable. Being assured that the locality and soil is suitable, the next consideration is shelter adequate to the locality. If such has not been provided, early May planting of a suitable hedge or trees should be undertaken. When put in early such plants make better establishment and more luxuriant growth during the following spring. There are few situations so favourable as to allow citrus-trees to be planted the same year as the shelter, and the advisability of cropping the land for a season and planting later must be considered.

If the proposed site does not possess a naturally free subsoil underdrains will be necessary, and these are best put in as the land

is being prepared. There is no hard-and-fast rule as to what distance apart drains should be laid; this will depend on the retentive nature of the soil. Though the larger sizes of tiles are more expensive they are to be preferred to those of small diameter, because not only do they provide a clearer outlet for surplus water, but the extra air-cavity has an extended pull under the land.

On most land areas there will be found surface depressions which are better filled prior to tree-planting, otherwise the hollows will be a constant lodgment area for water, to the detriment of tree-establishment.

In the case of established citrus-groves all drains should be examined and cleared, and the surface-soil regulated in the working to allow easy get-away for surplus water.

Disease-control.—In anticipation of citrus brown-rot during the wet period it is as well to take preventive measures now. All branches which sweep the ground or hang within 1 ft. of the soil should be cut away, as it is on these that the spores first find lodgment when splashed up from the soil. Precautionary measures are of a threefold character: (1) Sterilization of the soil where the spores reside; this is usually done with sulphate of iron—2 lb. per tree—worked into the surface-soil. (2) Pruning away lower branches of the trees, so that spores missed by sterilization are not so readily lodged on the tree by rain-splashes from the soil. (3) An application of bordeaux, 4-4-40, to the trees in early winter, which acts as a preventive of germination to such spores as chance to alight on the covered parts.

In certain localities where brown-rot is not prevalent part of this treatment may suffice, but it is well to be prepared in the entirety, as each of the three operations is good practice for other reasons. No. 1 improves the general tone of the tree; No. 2 allows better cultivation; and No. 3 is good against verrucosis and grey-scab.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

TUBERCULOSIS.

At this period of the year it is well to keep a sharp lookout for any bird showing signs of being affected with tuberculosis, as at no time is it more prevalent than just before or just after the moulting-period. The disease chiefly affects adult stock. It is caused by a micro-organism known as tubercle bacillus, and the chief source of infection is through the digestive tract. The droppings of the affected bird contain enormous numbers of the deadly germs, and it will therefore be readily understood that the feed, &c., may easily become contaminated and the disease spread at an alarming rate. Usually tuberculosis attacks flocks where the surrounding conditions are insanitary, and where the birds are poorly fed and do not possess a vigorous constitution. The disease is very contagious, and if it once makes its appearance in a flock there is no telling when it may be stamped out.

Tuberculosis is undoubtedly the worst disease the poultry-keeper has to fear in this country, chiefly because in its early stages there are no definite signs by which it can be detected. As the disease develops many signs manifest themselves which are apparent to the person with experience. A gradual loss in weight and an apparent shrinkage of the body is perhaps the first and plainest sign of the disease. Then the breast-bone stands out sharply and the neck is devoid of flesh. Later the comb becomes dark and the bird gets dull and listless, and is not inclined to mix with other members of the flock. Sometimes at this stage diarrhoea accompanies the disease, and there is lameness in one leg. From then on the disease rapidly develops, the bird becomes more and more emaciated, and finally dies. When a diseased bird is opened up the liver and spleen are usually found to be spotted with tubercular nodules. Sometimes the terms "spotted liver" and "going light" have been used to designate the condition of a bird whose liver presents this appearance. Usually, however, it is tuberculosis and nothing else.

For this disease there is absolutely no cure. The only way to fight it is to prevent it, and the first requirement in this direction is to breed birds with the necessary constitutional vigour to resist the infection should they come into contact with it. Any bird showing similar symptoms to those described above should be killed and opened up, and if the disease is present the body should be burnt without delay. Drastic methods of suppression are most necessary. The houses where the affected birds have been kept should be thoroughly cleaned and all sources of infection removed. This should be followed by a good spraying of strong sheep-dip or similar preparation. Until the disease is thoroughly stamped out all the droppings should be carefully gathered up and burnt or deeply buried with lime. When possible the quarters where infected birds are found should be given a rest, and the runs turned up, heavily limed, and sown down. It may be mentioned that tuberculosis and other diseases which affect poultry can always be better controlled when the floor of the house is made of concrete.

It must be again emphasized that prevention is the only way of combating tuberculosis. It is therefore imperative that the environments should at all times be as sanitary as possible, and the birds strengthened and invigorated by good feeding and sensible management generally.

CULLING THE WRONG BIRDS.

While watching various lines of poultry being sold at an auction-mart recently, an owner of a crate of White Leghorn hens, which were alleged to be his culls, sought my opinion regarding them. As they were generally good specimens of their breed, late moulters, and possessed striking signs of having produced heavily, I at once expressed an opinion that with the exception of an odd bird or two the line would make good breeding-specimens for any one requiring such birds. This surprised the owner, who went on to say that he weeded out these particular birds because they were the roughest looking in the flock, and as they were more or less devoid of feathers on the head he was afraid that this indicated a

form of disease. It is to be feared that this is only one case in many where the future profit-makers and most desirable breeding-specimens have been discarded, while the drone types have been retained on the plant. It has been proved over and over again that late autumn is the best time for culling a flock, and that the heaviest layers are the thinnest at this period and present the most worn and shabby appearance, while the heaviest and best-looking birds—those that have moulted and renewed their feathers—are the drones.

With regard to the question of the head going bare, it is safe to say that, particularly with White Leghorns, it is only the best layers in the flock which become affected in this way, and for what reason it is difficult to say. This so-called trouble need cause no anxiety to the poultry-keeper, as the bare places will feather over after the moulting-period.

DESTROYING INSECT PESTS.

In the *Journal* for last December some particulars were published relative to an experiment conducted at the Wallaceville Poultry-station on ridding fowls of insect pests by applying Black Leaf 40 to the perches. Since the result of this experiment was published I have received numerous inquiries to the following effect: What is Black Leaf 40? Where is it procurable? To what extent should it be diluted with water, and is the treatment likely to injure the birds? Some of the inquiries may well be answered here.

Black Leaf 40 is a by-product of tobacco. It is sold in liquid form in various-sized tins by vendors of orchard sprays and others. Providing this material is applied to the perches undiluted and as advised in the *Journal* referred to, it will undoubtedly have the effect of destroying any vermin that might be on the fowls, and will in no way injure the latter or lower the egg-yield. One correspondent advised me that he diluted the Black Leaf 40 with water before applying it to the perches, and that it by no means had the desired effect of destroying the vermin. He now informs me that after using the material in its undiluted form he could not find a living louse on any bird in the flock. Here it may be mentioned that the nicotine preparation is too costly to waste. All that is required is a thin line of the liquid poured on to the perch just before the birds go to roost. If there is much dust on the perch the liquid is apt to run off and become wasted, and to prevent this it is a good plan to first rub the perches over with a damp cloth. If this is done the liquid can be more easily applied to the centre of the perch and the risk of wastage will be reduced to a minimum.

As a result of observations already made in connection with a further experiment that is being carried out with Black Leaf 40, I have every reason to believe that in addition to destroying those kinds of insect pests which continuously live on the bodies of fowls, it will also tend to a great extent to keep the red-mite at bay, and also the minute parasite which is responsible for the common trouble known as scaly leg in fowls. While the great value of the

Black Leaf 40 treatment for rapidly destroying certain kinds of parasitic life that live on poultry has been amply demonstrated, it should not be taken for granted that this is the one and only correct way of dealing with these enemies. As with most troubles affecting poultry, the only really feasible way of fighting vermin is to prevent them from making their appearance. The maintaining of the birds in good health and vigour by sound and liberal feeding, together with strict attention to cleanliness and provision of good dusting-places, are among the essentials for keeping parasitic life at bay.

—F. C. Brown, *Chief Poultry Instructor, Wellington.*

THE APIARY.

MANAGEMENT OF SUPERS.

As recommended last month, the removal of the supers should go on steadily as the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and undue crowding. In these cases it is best to leave the supers on till spring.

The best place for winter stores is in the hive. However careful the beekeeper may be in replenishing stores, if the honey is removed from the hives he still runs the risk of allowing the bees to starve out if the honey is not within their reach at all times during the cold weather. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, and the bees require food at all times and seasons. On no account should the bees be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show whether this state of affairs obtains, and, if so, the bottom story should be removed, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

MATS FOR WINTERING.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are

very durable. Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

CLEARING WEEDS.

Weeds and long grass should be kept down. A good clearing round the hives in the autumn will suffice until the spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated and the weeds raked up and destroyed.

CARE OF HIVES.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground the height of one brick, and if the situation is damp or lowlying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards, and will thus be more likely to keep dry. Never rest the bottom-boards on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before winter weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the super. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because it will usually be found that towards the end of the honey-flow the bees will use up much valuable time in gathering propolis to stop up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

LEAKY HIVE-COVERS.

Apart from disease, there is no worse feature in any apiary than leaky roofs. A cover which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost occurs. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more obnoxious than does their owner.

There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should either cover them with zinc, ruberoid, or some other waterproof material; or, if economy must be practised, he should cover with

cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

THOSE who are curing and storing tobacco-leaf should carefully consider the following points:—

While the curing-barns require ample ventilation, especially for drying off the leaf as soon as it is cured, a cold draught, particularly in humid weather, will do much harm, spoiling the colour and setting up fungus growth. This means that the ventilators and blinds require proper adjustment as the weather changes and curing proceeds. The importance of this attention increases as late autumn approaches, but it should at all times be carefully watched.

Buildings for curing leaf must be weatherproof. If the roof leaks and drips occur occasionally, moulds will become established and rapidly spread, making endless difficulties.

Waste leaf and stalks littered about the floor and round the building will decay and infect valuable stocks. Cured tobacco-leaf is very sensitive to dirty and musty flavours, which quickly displace the fine natural aroma if the leaf is exposed to contamination.

When charging the barn all plants on the sticks must be evenly spaced. Eight pairs of plants may be slung on a stick 4 ft. 6 in. in length, and these sticks should all be 1 ft. apart on the tier poles, also the tips of the plants above must not overlap the butts of the plants on the tier below. Neglect of this precaution delays curing and is the frequent cause of "pole burn." These are dark spots on the leaf without elasticity and very tender—in fact, the affected area has rotted. Proper spacing throughout the barn enables adequate ventilation to be given to all parts at the right time, and so enables one to control the conditions necessary for a proper cure.

Leaves or plants harvested with dew or rain upon them easily bruise, become bedraggled, and never develop a proper texture. These are only a few of the evils which arise from this practice, which is quite incompatible with good results.

Shed-room at harvest-time is usually tested to the utmost, and systematic shed management must be carefully worked out, so as to use the space to best advantage. The upper tiers, probably because they are more inaccessible, are sometimes comparatively little used, while the lower tiers are congested with leaf at different stages of development. A suitable system must make use of all the available space, and in such a way that the development will proceed systematically from top to bottom or from end to end. This not only saves labour by facilitating handling, but leaf at different stages can be given its necessary treatment.

Most important of all is the fact that bright well-cured leaf that is stripped and tied up into hands cannot be left about without rapidly deteriorating. As before stated, leaf at this stage is very sensitive, and quickly loses aroma, texture, and colour, as well as acquiring foreign odours, unless it is properly stored. Leaf is best bulked in a good clean ceiled room that is warm and dry, and occasionally ventilated in fine weather. It may be stacked, with the butts of the hands outward, about 4 ft. to 5 ft. wide, and the same height, with a few boards and weights on top to compress it, and keep the air out. This should be done when the blade of the leaf is in soft condition. The bulk should be examined occasionally for the first week or so, to see that it does not heat or any deleterious development take place. If that happens it must be aired or reconditioned before restacking.

SMALL-FRUITS.

Organic manures that have been accumulated and cured during summer and autumn should now be spread between the rows of bush fruits and lightly ploughed in. These plants crop heavily and require generous treatment. The tomato-plant is a more delicate feeder, and on land that is to be planted with that crop next season a green cover-crop, such as oats and horse-beans, sown now is often very suitable.

Where new breaks of bush fruits or strawberries are to be planted the work should be done now as soon as possible, in fine weather, and only on land that has been thoroughly prepared.

THE CHINESE GOOSEBERRY.

Regarding that handsome vine the Chinese gooseberry (*Actinidia chinensis*) a Californian correspondent, writing to a contemporary publication, states: "The several notes that have appeared recently on this fine vine, and the fact that one correspondent has the fruiting form, prompts the remark that if this is also in cultivation it is the easiest possible matter to graft it on the male form and have both. We have found this *Actinidia* the easiest subject to graft; scions will unite overnight, as may be proved by using two branches, grafting them, and placing them in a warm, moist house, and the next day new cambium will have formed. *Actinidia chinensis* is hard to root from cuttings. It may be layered easily; with us it will climb to the top of the highest trees. The fruits are very palatable, easily peeled after scalding, and in China they are making an excellent 'gooseberry' jam of it. Seeds when available are germinated readily, and the seedlings when large enough are easily grafted with both forms, if desired. There is a suspicion here that there are plants that possess the ability to fruit when planted alone. We have seen this occur, and can only reason that some individuals possess both reproductive organs."

The commercial possibilities of Chinese gooseberry remain to be proved, but it appears to be harder than was at first expected, and is doing well in many places in this country. Being handsome and vigorous, the plant also has a considerable ornamental value.

THE MARKET-GARDEN.

In this section the most important seasonal work consists of planting out the crop of spring cabbage and cauliflower on a piece of land that is warm and well prepared; completing the earthing-up of celery; and cutting and clearing away the asparagus growth before the seeds fall. This last crop will benefit generally from a good dressing of well-cured organic manure turned in, as also will the rhubarb crop.

Seed-beds of lettuce are generally sown now in frames or in glasshouses for early spring planting. The "rust" disease that often attacks the plants will be avoided if they are sown thinly and given plenty of air at all times. However, the plants must be kept dry to avoid this trouble. In the frames this may be done by giving plenty of side ventilation.

Harvesting the winter crop of savoy has already commenced, and will be followed by crops of celery, leeks, and broccoli. Crops of potatoes and onions now in store will require attention until they are well dried off. Potato-seed for another season should now be obtained and given careful storage.

Vacant ground should not be neglected; grassland should be carefully broken in; and fallows sown down in a green crop, or well dressed with organic manures and turned over in preparation for spring planting and sowing. This early preparation is most important; it destroys noxious insects in the soil as well as harmful weeds, and thus gives a good and early start to the crops which follow. Successful cropping depends very largely on these measures.

SHELTER-TREES AND HEDGES.

Another important factor in the successful management of orchards and gardens is well-placed and carefully tended shelter-belts. These should now be topped and thinned or trimmed, as may be required, and the litter piled and burnt. Too much attention cannot be given to this important matter at present. Where new plantings of this kind have to be made, the land should be cleaned and kept cultivated until the plants are well established.

—W. C. Hyde, *Horticulturist, Wellington.*

Appreciation of the New Zealand Dairy-produce Grading System.—In a recent report to the Director of the Dairy Division, Mr. W. Wright, Inspector in Britain, remarks: "It is very pleasing to be able to pass on to you the compliment paid to the grading staff of New Zealand by representatives of two of the large Liverpool provision houses yesterday. In the course of conversation the statement was made by one firm that for two years there had been no examinations made of New Zealand butter handled by them, nor had any complaints been received from buyers. It was also admitted by the other firm that no examinations of New Zealand butter had been made in their warehouse during the current season. It was stated that this confidence in the quality as indicated by the grade marks is the result of the efficient work of the graders in New Zealand, testifying to the skill and good judgment of quality by the staff. This, I think you will agree, is a great compliment, unsolicited in any shape or form, and illustrates the beneficial results of an efficient grading policy."

TESTING OF PUREBRED DAIRY COWS.

CLOSING C.O.R. LIST FOR 1928.

Dairy Division.

THE appended list, comprising eighty-seven names, completes the publication of individual records for certificates granted in 1928. It will be noticed that, despite the fact that two-year-olds comprise a large proportion of the list, no less than thirty-five out of the total of eighty-seven cows have been credited with yields in excess of 500 lb. butterfat.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old						
Someview Dairy Girl	A. E. Phillips, Maunu ..	1 325	240·5	365	10,787·0	580·83
Glencoe Buttermaid	A. E. Phillips, Maunu ..	2 57	246·2	365	9,731·2	577·02
Jersey Brae Sunset ..	T. Church, Te Rapa ..	1 351	240·5	365	8,997·9	516·48
Woodstock Sue ..	A. Banks and Son, Kiwitea ..	2 10	241·5	365	8,548·6	502·62
Uruti Pride ..	W. Oxenham, Uruti ..	1 306	240·5	365	9,176·4	484·28
Holly Oak Doris ..	J. A. Mitchell, Longburn ..	2 20	242·5	365	8,018·8	478·92
Beaulieu Lalac's Princess	Dr G. Walker, Maunu ..	1 334	240·5	365	8,834·7	476·35
Otterburn Victress ..	Estate of A. A. Wagstaff (deceased), Waihou	1 275	240·5	300	7,227·8	459·95
Uruti Angleen ..	W. Oxenham, Uruti ..	2 17	242·2	365	8,720·1	452·68
Jersev Farm Owlet ..	H. R. Benbow, Ormondville	1 361	240·5	365	7,958·0	420·96
Woodstock Morn ..	A. Banks and Son, Kiwitea ..	2 01	249·6	282	7,127·2	415·85
Dovedale Sungleam†	R. Weinberg, Niho Niho ..	1 353	240·5	365	6,769·2	412·80
Aldan's Neat Maid ..	J. A. Mitchell, Longburn ..	2 44	244·9	355	7,149·3	401·51
Diana of Sunhill ..	C. Phillips, Otorohanga ..	1 325	240·5	365	6,522·3	396·74
Almadale Blonde ..	J. T. Entwisle, Cambridge..	2 10	241·5	333	7,104·0	361·92
Jersey Brae Winsome	T. Church, Te Rapa ..	2 2	240·7	365	6,739·2	361·80
Llangollen Flower ..	J. T. Entwisle, Cambridge..	1 342	240·5	350	6,950·4	356·80
Claiouet's Victress ..	B. N. and W. Sandilands, Feilding	2 19	242·4	285	5,305·5	350·33
Uruti Mavis ..	W. Oxenham, Uruti ..	1 302	240·5	308	7,031·2	350·25
Rosebury Julia ..	J. T. Entwisle, Cambridge..	1 289	240·5	348	6,342·6	341·51
Beaulieu Silver Lily ..	Dr. G. Walker, Maunu ..	2 68	247·3	365	7,279·1	339·54
Wonder Maiden ..	B. N. and W. Sandilands, Feilding	1 362	240·5	314	5,394·3	338·64
Mistress of O.K. ..	E. Jamieson, Paeroa ..	2 26	243·1	364	6,383·5	335·68
Orange Dale Eventide	W. J. Hall and Son, Matatoki	1 275	240·5	333	6,534·5	315·36
Rower's Carnation ..	J. T. Warman, Katikati ..	1 313	240·5	365	5,537·5	293·03
Daffodil of Stonycroft	S. Unwin, Winchester ..	1 360	240·5	365	5,476·3	288·20
Senior Two-year-old.						
Holly Oak Bouquet ..	R. S. Tuck, Waharoa ..	2 350	275·5	365	10,989·0	644·99
Middlewood Baby ..	Kilgour Sisters, Kiwitea ..	2 359	276·4	365	8,482·6	506·50
Takapu Ladylike ..	R. C. Jury, Tikorangi ..	2 108	251·3	344	7,999·3	489·44
Silverstream Elite ..	G. B. Hull, Silverstream ..	2 94	249·9	365	7,584·0	357·68
Three-year-old.						
Snow View Bonnie ..	R. S. Tuck, Waharoa ..	3 312	308·2	365	11,628·0	717·04
Tolgarth Angerline ..	Late W. T. Williams, Pukehou	3 324	309·4	365	10,801·8	686·67

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cent.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued

<i>Three-year-old—continued.</i>						
Kowhai Sunshine ..	J. A. Mitchell, Longburn ..	3 99	286·9	365	10,020·1	582·03
Jersey Meadows Curly ..	H. H. Phillips, Te Rehunga ..	3 10	278·0	365	7,999·4	500·13
Rewa Sainton ..	A. Christie and Co., Tane-kaha ..	3 22	279·2	343	8,597·3	494·26
Dominion Godetia ..	Ruakura Farm of Instruction, Hamilton ..	3 351	312·1	338	9,080·4	476·72
Sybil's Majesty's Pride ..	Late W. T. Williams, Pukehou ..	3 54	282·4	364	8,068·4	442·04
Pelynn Bright Star ..	L. K. Tarrant, Ngaere ..	3 312	308·2	344	7,321·0	437·19
Ribbonwood Girlie ..	Cook Hospital Board, Gisborne ..	3 45	281·5	365	8,410·0	415·03
Silverstream Erica ..	G. B. Hull, Silverstream ..	3 294	306·4	351	7,472·1	384·66
<i>Four-year-old.</i>						
Distinction's Tiny ..	A. E. Phillips, Maunu ..	4 25	316·0	365	10,665·9	639·68
Violet's Gift ..	F. Phillips, Otorohanga ..	4 349	348·4	351	11,075·6	527·97
Mercedes Loo's Majesty ..	A. Christie and Co., Tane-kaha ..	4 144	327·9	365	8,408·8	461·34
Jenny's Queen ..	R. S. Tuck, Waharoa ..	4 317	345·2	335	6,556·2	365·95
Orange Dale Sylvia ..	C. I. Phillips, Otorohanga ..	4 98	323·3	322	6,494·4	330·86
<i>Mature.</i>						
Otterburn Lilac ..	R. S. Tuck, Waharoa ..	5 119	350·0	365	13,626·6	729·54
Viola's Fair Lady ..	R. Harper, Otorohanga ..	7 5	350·0	365	10,054·8	679·02
Springdale Lady Oculist ..	J. A. Blake, Waipawa ..	6 40	350·0	365	12,868·0	666·29
Ansercine ..	Late W. T. Williams, Pukehou ..	13 72	350·0	364	12,948·3	631·82
Waipiko Rosina ..	J. A. Mitchell, Longburn ..	10 8	350·0	356	11,660·2	585·24
Abberly Naomi ..	Dr. G. Walker, Maunu ..	8 32	350·0	365	11,693·6	544·96
Cowslip's Mischief ..	Late W. T. Williams, Pukehou ..	5 308	350·0	357	9,752·9	522·22
Takapu Daisy ..	R. C. Jury, Tikorangi ..	6 67	350·0	328	8,517·5	520·87
Rewa Maycan ..	Dr. G. Walker, Maunu ..	9 22	350·0	325	8,664·9	495·71
Bouquets Carnation ..	J. A. Blake, Waipawa ..	5 146	350·0	337	8,181·7	449·76
Lady Pansy Dudley ..	Dr. G. Walker, Maunu ..	5 92	350·0	283	5,325·7	374·97

FRIESIANS.

<i>Junior Two-year-old.</i>						
Rosevale Burkeyje ..	North and Sons, Omimi ..	1 223	240·5	365	17,908·6	586·07
Sylvia Posch* ..	T. Sheriff, Clandeboyne ..	2 47	245·2	365	18,043·3	583·88
Melrose Sylvia Model Keyes* ..	North and Sons, Omimi ..	2 133	253·8	365	17,499·0	569·88
Rosevale Sylvia Colanthes Posch* ..	North and Sons, Omimi ..	2 126	253·1	365	15,737·9	543·28
Greenhill Burke Queen 2nd* ..	J. I. Royds, Christchurch ..	2 87	240·2	365	15,591·5	541·55
Lichfield Madge Ormsby† ..	W. J. Polson, Fordell ..	2 43	244·8	365	12,212·4	445·43
Livingstone Jessie Beets ..	W. J. Eames, Hunterville ..	2 29	243·4	340	11,380·6	414·39
Hobson Mona Beauty ..	V. E. Aitkenhead, Parakai ..	2 49	245·4	365	9,393·4	327·89
Tamahine Clover ..	W. Bryant, Otokia ..	2 29	243·4	365	6,931·6	301·72
Hobson Westport Pontiac ..	Hobson Farm Ltd., Wharepapa ..	1 336	240·5	365	8,863·9	296·53
Hobson Princess Valdessa ..	Hobson Farm Ltd., Wharepapa ..	1 328	240·5	285	7,825·0	285·45

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

FRIESIANS—continued

<i>Senior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Lichfield Glen Lady†	W. J. Polson, Fordell ..	2 337	274·2	365	14,243·9	478·61
Anawhata Pietje Pontiac Minto 13th	P. F. Boucher, Kumeu ..	2 325	273·0	310	9,323·0	345·48
<i>Junior Three-year-old.</i>						
Anawhata Dorothy Minto 12th	P. F. Boucher, Kumeu ..	3 7	277·7	303	9,321·7	351·56
<i>Senior Three-year-old.</i>						
Rosevale Echo Sylvia Colantha*	North and Sons, Omimi ..	3 194	296·4	365	17,881·7	666·38
Merrylea Inka Keyest†	McDonald and Co., Waitati	3 322	309·2	352	12,394·7	417·66
<i>Junior Four-year-old.</i>						
Bainfield Netherland Duchess 2nd*	Fraser and Kirkness, Waikiwi	4 27	316·2	365	16,125·2	634·54
<i>Senior Four-year-old.</i>						
Rosevale Helena Waldorf Posch*	North and Sons, Omimi ..	4 326	346·1	365	18,886·3	656·13
<i>Mature.</i>						
Regina Posch of the South*	H. North and Sons, Omimi	6 263	350·0	365	21,490·7	823·66
Rosevale Isobel* ..	H. North and Sons, Omimi	9 31	350·0	365	24,523·3	773·31
Rosevale Sylvia Beets de Kol*	H. North and Sons, Omimi	5 332	350·0	365	19,479·1	610·54

MILKING SHORTHORNS.

<i>Mature.</i>						
Allandale Honor† ..	R. S. Allan, Hatuma ..	8 39	350·0	365	16,802·5	561·43
Allandale Garnett† ..	R. S. Allan, Hatuma ..	6 22	350·0	365	15,374·9	498·58

GUERNSEYS.

<i>Three-year-old.</i>						
Dominion Du Preel ..	Ruakura Farm of Instruction, Hamilton	3 332	310·2	365	9,260·3	487·46

*Second-class Certificates.***Jerseys.**

<i>Junior Two-year-old.</i>						
Beaulieu Sonmise Girl	Dr. G. Walker, Maunu ..	1 345	240·5	365	6,968·8	419·54
Silverstream Whin ..	G. B. Hull, Silverstream ..	2 0	240·5	365	6,606·6	353·72

<i>Mature.</i>						
Dominion Ideality ..	Ruakura Farm of Instruction, Hamilton	5 243	350·0	365	10,441·1	551·95

Friesians.

<i>Junior Two-year-old.</i>						
Hanley Netherland Queen*	G. H. Hassall, Clarkville ..	2 80	248·5	365	16,769·9	602·77

<i>Senior Three-year-old.</i>						
Bainfield Sylvia Clover 2nd	W. Bryant, Otokia ..	3 297	306·7	365	11,316·5	406·23

LIST OF RECORDS—continued.

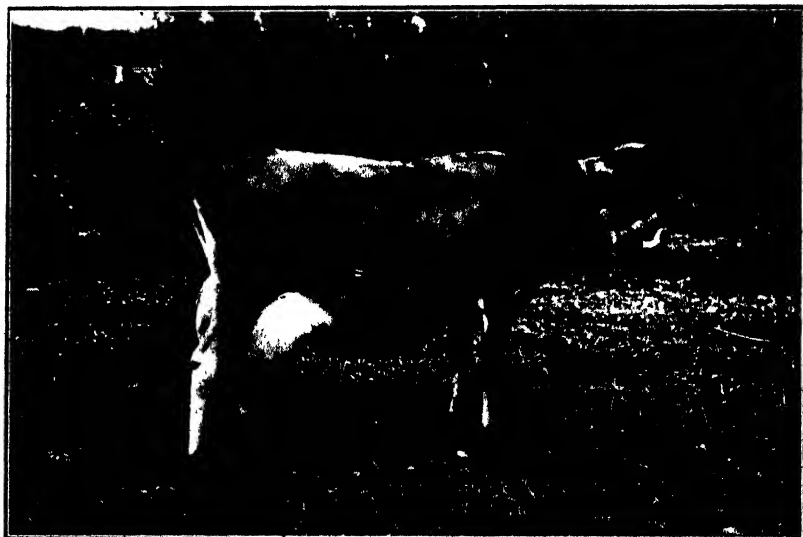
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

*Second-class Certificates—continued.***Ayrshires.**

<i>Mature.</i>				<i>At birth.</i>		Yrs. dys.		lb.	lb.	lb.
Maesgwyn Maire	..	C. M. Williams, Kaiapoi	..	6	57	350.0	365	16.4	19.9	638.80

Red Polls.

<i>Two-year-old</i>									
Dominion Fairy Gold		Central Development Farm, Weraroa		2	277	268.2	365	6,571.1	305.51



CRAIGALEA BONNIE (J. G. ROBERTSON, ELTHAM).

C.O.R. in Jersey four-year-old class: 12,664.3 lb. milk, 728.58 lb. butterfat. Highest record for the class in 1928.

Arthritis in Lambs.—The Officer in Charge, Wallaceville Veterinary Laboratory, reported recently: "Eight lambs sprayed in the cut scrotum or on the tail-stump with culture from definite cases of arthritis developed severe lameness. None did well during the season and are culls. One developed a typical joint, as found in the freezing-works, and a second has a deformed spine, apparently due to abscess-formation. Field-work is still lacking in connection with this disease, but cleanliness in docking is obviously the solution, together with clean paddocks following docking."

CLASSIFICATION OF CATTLE IN NEW ZEALAND AT 31st JANUARY, 1928.

Land District (including Interior Boroughs).	Bulls Two Years Old and over, for Stud Purposes.				Cows and Heifers Two Years Old and over, for Dairying Purposes.		Other Cows and Heifers Two Years Old and over.	Heifers, One and under Two Years Old.	Steers Two Years Old and over.	Steers and Bulls One and under Two Years Old.	Calves under One Year Old.		Total Cattle.
	For Beef Purposes.	For Dairy Purposes.	In Milk	Dry.	Heifer.	Steer.							
North Auckland	795	7,381	202,392	18,923	37,281	56,443	46,538	16,894	61,608	16,803	465,058		
Auckland	1,266	12,637	350,770	23,743	53,499	80,016	66,391	19,722	99,953	16,871	733,868		
Gisborne	2,863	1,205	29,935	5,065	102,877	58,100	46,326	19,120	34,277	25,627	295,491		
Hawke's Bay	1,418	1,706	45,512	5,904	49,500	18,641	35,186	9,872	21,996	13,041	202,779		
Taranaki	468	7,489	196,955	10,224	21,850	38,727	19,141	7,036	48,471	6,441	356,802		
Wellington	3,579	6,802	180,046	18,145	128,423	61,171	97,809	28,162	67,967	34,100	626,204		
Nelson	127	1,227	25,337	3,479	6,762	7,173	5,889	2,857	7,546	3,080	63,486		
Marlborough	155	680	14,320	2,031	5,293	4,896	4,153	2,370	4,910	2,238	41,046		
Westland	182	501	10,929	1,531	7,489	4,123	5,855	2,493	4,545	2,588	40,206		
Canterbury	370	2,889	69,991	7,968	14,512	19,275	16,791	7,300	19,369	7,280	165,745		
Otago	243	2,006	49,299	6,599	10,396	14,898	13,210	6,394	15,163	7,125	125,423		
Southland	244	3,011	67,243	6,057	13,307	20,152	12,264	6,728	19,866	8,879	157,751		
Totals, Dominion, 1928	11,710	47,624	1,242,729	109,669	451,189	362,624	399,553	128,918	405,671	144,082	3,273,769		
Totals, Dominion, 1927	11,972	46,870	1,181,545	121,680	482,973	384,743	384,525	158,459	357,658	127,304	3,257,729		

—Census and Statistics Office.

WEATHER RECORDS: MARCH, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THE month of March was a very wet one over much the greater part of the Dominion. In many districts the average fall was greatly exceeded. Slight deficits were experienced at scattered places in the central parts of the North Island from Taranaki to Hawke's Bay, and from the Bay of Plenty to the Wairarapa. A few places in Canterbury, South Westland, and Southland also had less than the normal.

The rain, following on a dry February, was very beneficial. Pastures are in a good condition and prospects for winter feed favourable over almost the whole country. Stock and crops also were in good condition at the end of the month. Temperatures were slightly below normal, especially in districts with an easterly aspect, where also there was considerable cloudiness. In a few cases the damp and dull weather has interfered with harvesting operations.

Among the outstanding features of the month was a cyclone of very small dimensions, which, after having been met by the s.s. 'Tofua' on her way from Fiji to Auckland, crossed from the Bay of Plenty to Poverty Bay between the 17th and 18th. Gales of great severity, though fortunately of short duration, were experienced, and some damage was done in the environs of Opotiki and Gisborne. Another feature was the torrential downpour which occurred during a southerly gale over the eastern portions of Otago on the evening of the 19th. Around Dunedin the falls varied between about 4 in. and 11 in., the heaviest occurring in the watershed of the Leith Stream. The Leith rose rapidly to record flood-level, and, in addition to doing very serious damage along its own banks, caused heavy flooding of the northern business portion of Dunedin. Oamaru also recorded over 6 in. of rain, and experienced heavy flooding accompanied by some damage to property.

Still another unusual phenomenon was the occurrence of aurora australis on four nights during the month—the 10th, 12th, 13th, and 17th. The display of the 12th was particularly brilliant. Large spot groups were noted on the central portion of the sun on or about these days.

On the 1st an intense cyclonic storm had developed east of Brisbane. This storm remained in the northern Tasman Sea until the 4th, after which it disappeared without affecting New Zealand to any very great extent. On the 5th, however, a deep southern depression advanced from the Tasman Sea, and had not completely crossed the Dominion until the 8th, when strong southerly winds set in. General rain fell, culminating on the 6th in very heavy falls over most of the North Island and the Nelson and Westland provinces. Some flooding was caused on the west coast, especially at Greymouth.

On the 17th another deep depression developed in the south Tasman Sea, and became cyclonic before reaching New Zealand. The centre crossed northern Otago on the evening of the 19th, and the floods mentioned above were associated with it. Southerly gales followed in its wake. In addition to the specially heavy falls described, rain was general in other districts. Snow fell on the ranges of the South Island. The weather was cold between the 20th and the 22nd, and frosts occurred at southern inland stations.

The storm of the 19th was followed by an intense anticyclone, which did not move finally away eastward until the 25th. On this date another intense depression developed in the south Tasman Sea, and caused unsettled weather until the end of the month. There were northerly gales on the 26th and 27th, especially about Cook Strait. Rain was again general, with many heavy falls. The change to southerlies came on the 30th, when snow fell on the high country of the South Island and low temperatures were experienced. The 31st was still more severe, and frosts were recorded at many places. The southerlies were of gale force at many places on the 30th and 31st.

There was again a relative absence of westerly winds and a prevalence of southerlies during the month.

—Edward Kidson, Director of Meteorological Services, Wellington, 5th April, 1929.

RAINFALL FOR MARCH, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitaia	4.09	10	1.10	3.58
2	Russell	2.74	13	1.15	3.13
3	Whangarei	6.04	15	1.85	4.52
4	Auckland	5.62	16	2.33	3.03
5	Hamilton	5.50	12	1.77	3.88
6	Kawhia	6.62	15	2.08	3.43
7	New Plymouth	4.69	15	0.90	3.62
8	Riversdale, Inglewood	6.57	15	2.04	7.39
9	Whangamomona	6.10	12	1.50	5.61
10	Eltham	2.53	12	0.62	4.68
11	Tairua	4.28	11	1.44	5.92
12	Tauranga	4.68	12	1.84	4.16
13	Maraekaho Station, Opotiki	4.16	12	1.66	4.09
14	Gisborne	3.38	13	0.99	4.51
15	Taupo	4.80	13	1.58	3.25
16	Napier	3.81	16	2.35	3.26
17	Maraekakaho Stn., Hastings	2.74	11	0.68	3.10
18	Taihape	2.42	15	0.44	2.95
19	Masterton	1.86	13	0.91	3.15
20	Patea	3.77	13	1.00	3.62
21	Wanganui	2.17	10	0.60	2.62
22	Foxton	2.80	9	0.66	2.20
23	Wellington (Karori Reservoir)	4.79	17	2.08	3.48
<i>South Island.</i>					
24	Westport	9.57	17	2.39	5.80
25	Greymouth	13.04	17	3.50	8.70
26	Hokitika	11.90	18	2.81	9.70
27	Ross	13.49	13	3.58	10.35
28	Arthur's Pass	15.82	11	5.57	9.74
29	Okuru, Westland	14.78	14	2.72	15.48
30	Collingwood	11.63	11	3.12	4.10
31	Nelson	5.44	10	1.31	3.08
32	Spring Creek, Blenheim	4.15	12	1.85	2.16
33	Tophouse	7.18	12	1.45	4.33
34	Hammer Springs	3.74	14	0.48	2.80
35	Highfield, Waiau	2.68	10	0.50	3.00
36	Gore Bay	2.21	12	0.43	2.29
37	Christchurch	3.49	11	1.13	2.05
38	Timaru	3.62	10	2.22	2.31
39	Lambrook Station, Fairlie	2.42	8	1.22	2.47
40	Benmore Station, Clearburn	4.14	8	2.56	2.60
41	Oamaru	7.47	11	6.16	1.73
42	Queenstown	3.99	10	0.85	2.60
43	Clyde	1.86	6	0.83	1.50
44	Dunedin	7.47	14	5.29	2.98
45	Wendon	4.03	10	2.00	2.68
46	Gore	3.08	5	1.15	3.27
47	Invercargill	4.36	21	0.70	3.90
48	Puysegur Point	9.34	18	2.12	8.00
49	Half-moon Bay, Stewart Is.	5.12	16	1.28	5.79

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STOMATITIS IN LAMBS.—MATING OF EWES.

G. W., Waipapa, Bay of Islands :—

(1) A number of my lambs in December became affected with sore mouths and sores at the base of the nose. The lambs were still on the ewes. The trouble lasted for about three weeks, after which time all the lambs recovered. Could you suggest the cause of the trouble and a safeguard against further infection. The sheep are on top-dressed flat land. (2) What time should elapse before the rams are put with newly dipped ewes? (3) What number of young rams should be run per 100 ewes in small paddocks on clear ground?

The Live-stock Division :—

(1) This trouble is known as stomatitis, and may be transferred to the udder of the ewe from the affected lamb's mouth. Although the disease is contagious in nature, it is not considered a very serious complaint, and lends itself to treatment. It is advisable to give the sheep a change of pasture, and, if desired, isolate the affected lambs along with their mothers. A simple ointment will cure the disease—one part of flowers of sulphur and eight parts of vaseline or lard. Smear the ointment on the lamb's mouth, and in turn the lamb will apply it to the udder of the ewe. Stomatitis cannot really be safeguarded against unless the sheep and lambs are put on the shortest pasture available. (2) The rams may be put to the ewes as soon as the latter have dried, but it is a much better practice to have the ewes dipped at least one week before turning the rams out. (3) It is usual to allow two rams for 100 ewes, but they should not be all turned among the ewes at one time. It is better to have fresh rams to turn out after the lapse of a week or ten days.

HEIFER WITH WATERY EYE.

S. G. MOORE, Ruawai :—

I have a four-months-old heifer which has had a watery eye since birth. It is now discharging a little. Could you tell me if there is any cure?

The Live-stock Division :—

The cause of the trouble is probably partial occlusion of the duct which carries away the tears, or some other deformity which you can do little for. As the eye is now discharging you might treat as follows. Dissolve a dessertspoonful of boracic powder in half a medium-sized bowl of boiling water, and add a little cold water to cool it down. Wash the eye out every day. Procure a small tube of eye-ointment containing yellow oxide of mercury from a chemist, place a small portion under the eyelid, and allow it to work in itself. Do this daily after bathing. This treatment will perhaps prevent a growth forming, which very often happens where there is any irritation to the mucous membranes of the eye.

MILDEW AND RUST ON HAMS AND BACON.

M. F., Woodville :—

Could you give me a reliable recipe or method for preventing mildew and rust from forming on hams and bacon while being stored for a considerable period? My practice is to cure the bacon, then smoke it, and then roll it very tightly. The hams and shoulders are all boned before curing, so when they are rolled it reduces the mildew and rust to a minimum; but even so, with long keeping, parts are apt to become tainted with rust.

The Live-stock Division :—

One of the first things to be done after the hams and bacon are taken out of the salt or pickle is to see that the parts are properly dried by hanging out in the open in the sun and wind before smoking. It is a good practice to then dust all the portions with pea-flour. This will absorb all remaining moisture which may be in the crevices or joints. Then smoke and roll. Owing to the temperature of most places on the farm not being under control, it is wise to bag the hams and bacon for further protection. In some cases even this is not a sufficient safeguard, so a systematic examination is necessary periodically. Take off the bags and wipe the bacon and hams. Always choose a dry place with ventilation for hanging.

SALE OF CERTIFIED SEED-WHEAT.

With a view to stimulating the distribution of pure seed-wheat the Department of Agriculture, in co-operation with the Wheat Research Institute, organized in the 1927-28 season a system of seed-wheat certification, which was fully described in the *Journal* for April, 1928.

Briefly, certified seed-wheat is the produce of areas inspected in the field by an officer of the Department, machine-dressed, and passed by the official Grader. The price of certified seed-wheat is based on the current price of milling-wheat on 31st March, to which is added a bonus to growers, dressing and handling charges, and merchant's commission. Thus all certified seed-wheat is sold at a uniform price in any one centre.

The following firms are handling Solid-straw Tuscan and Hunter's certified seed-wheat at the places specified, and growers should apply direct to them for their requirements :—

<i>Blenheim.</i>	<i>Timaru.</i>
W. E. Clouston and Co	Canterbury Farmers' Co-operative Association.
	Wright, Stephenson, and Co.
<i>Rangiora.</i>	J. Meehan and Sons
N.Z. Farmers' Co-operative Association	Dalgety and Co
	N.Z. Loan and Mercantile Agency Co.
<i>Christchurch.</i>	D. C. Turnbull and Co
Dalgety and Co	A. B. Annand and Co
Pyne, Gould, Guinness.	Pyne, Gould, Guinness.
H. Matson and Co.	
N.Z. Loan and Mercantile Agency Co.	<i>Waimate.</i>
Wright, Stephenson, and Co.	Pyne, Gould, Guinness
Wood Bros	
N.Z. Farmers' Co-operative Association.	<i>Oamaru</i>
Canterbury Seed Co	Ireland and Co.
	Darling and McDowell
<i>Leeston.</i>	N.Z. Loan and Mercantile Agency Co.
Canterbury Seed Co	Wright, Stephenson, and Co
	North Otago Farmers' Co-operative Association
<i>Ashburton.</i>	<i>Dunedin.</i>
National Mortgage and Agency Co.	Waters, Ritchie, and Co.
Wright, Stephenson, and Co.	Dalgety and Co.
Pyne, Gould, Guinness.	N.Z. Loan and Mercantile Agency Co.
N.Z. Farmers' Co-operative Association.	

Mineral Hunger in Sheep.—The successful experiment in feeding mineral food to sheep by the pellet method, as recorded in the *Journal* for January last, has since been repeated on some sheep showing symptoms of bush sickness at the Mamaku Demonstration Farm, and with the same good results.

WHEAT AND OATS THRESHINGS, 1929 HARVEST.

TABULATED below are returns of threshings of this season's wheat and oat crops received by the Census and Statistics Office up to 19th March. It will be observed that at that date very little had been threshed in Southland, where the season is appreciably later than in North Otago and Canterbury.

Land District.	Wheat.					
	Firsts.			Seconds.	Total Threshed.	Average Yield per Acre.
	Tuscan or Longberry.	Hunter's (Varieties).	Pearl or Velvet.			
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Gisborne ..	452	116	..	24	592	16.44
Hawke's Bay ..	3,878	..	108	351	4,337	24.23
Wellington ..	27,681	5,934	26	1,956	35,597	34.63
Nelson ..	7,102	3,664	1,909	785	13,460	26.34
Marlborough ..	49,459	16,129	2,768	4,757	73,113	30.95
Canterbury ..	2,018,046	360,825	165,698	121,058	2,665,627	36.91
Otago ..	102,477	74,163	35,725	17,251	229,616	31.94
Southland ..	1,321	..	..	..	1,329	22.78
Totals ..	2,210,416	460,831	206,234	146,182	3,023,663	36.14

Land District.	Oats.					Average Yield per Acre.
	White.	Dun	Black.	Algerian.	Total Threshed.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Hawke's Bay ..	..	..	..	2,784	2,784	32.75
Wellington ..	2,021	264	..	14,833	17,118	44.81
Nelson ..	180	..	..	1,972	2,152	30.31
Marlborough ..	634	156	220	14,199	15,209	33.80
Canterbury ..	358,634	43,684	3,460	139,082	544,860	40.81
Otago ..	57,859	6,738	2,090	13,719	80,406	38.99
Southland ..	672	..	..	..	672	33.60
Totals ..	420,000	50,842	5,770	186,589	663,201	40.38

FORTHCOMING WINTER SHOWS.

ADVICES of the following shows have been received :—

Southland A. and P. Association : Invercargill, 11th to 18th May.

Whangarei A. and P. Society : Whangarei, 14th to 18th May.

Bay of Plenty Winter Show : Whakatane, 22nd to 25th May.

Waikato Winter Show Association : Hamilton, 28th May to 3rd June.

Otago A. and P. Society : Dunedin, 1st to 7th June.

Taumarunui and District Winter Show Association : 6th to 8th June.

Poverty Bay Winter Show Association : Gisborne, 12th to 15th June.

Manawatu A. and P. Association : Palmerston North, 18th to 22nd June.

South Taranaki Winter Show Company : Hawera, 28th June to 3rd July.

Auckland A. and P. Association : Auckland, 3rd to 13th July (provisional).

Wanganui A. and P. Association : Wanganui, 4th to 6th July.

Wellington Winter Show Association, 9th to 26th July.

Stratford A. and P. Association : Stratford, 10th to 13th July.

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No. 5.

A SURVEY OF PUMICE SOILS.

(Series continued.)*

THE SUBSOILS OF ROTORUA COUNTY.

B. C. ASTON, Chief Chemist, Department of Agriculture.

IN presenting the results of the analyses of the subsoils of Rotorua County in map form it will be profitable to discuss the meaning allotted to the terms "soil" and "subsoil" by various writers- since these terms are by no means always used in the same sense- and to define in what sense the terms are used in these articles. The top samples of this Rotorua Survey have always been taken to a uniform depth of 9 in. from the surface with a borer or auger, and are designated the "soil." Samples taken to a further depth extending from 9 in. below the surface to 18 in., and therefore representing the second stratum of 9 in. below the first, are termed the "subsoil."

The word soil is often used by agricultural writers to include both the soil and the subsoil. Woodward makes the important observation that the so-called soil maps of the United States, Germany, &c., are in reality subsoil maps with indications of the nature and depth of the soil at particular spots. The same word is also used in a special sense when referring to that portion of the soil which is cultivated by the plough, anything below this being termed the subsoil. The word subsoil may also be used in a general sense to indicate any layer of material, even rock, lying beneath the portion known as the soil. The term, however, is more generally used to include all that weathered material derived from rock, and having a soil-texture and a mechanical composition similar to that of the soil, but differing fundamentally from the soil in not containing the life or the remains of life (organic matter or "humus") which the soil contains, and which is the final ingredient in the evolution of a soil from the parent rock necessary to convert the unproductive lifeless mass into a fertile medium for the growth of crops.

Thus in its chemical composition, in addition to organic matter, the soil is richer than the subsoil in the mineral plant-food phosphoric

* The last article of this series appeared in the *Journal* for August, 1927.

acid, which by the aid of life tends to ascend from the subsoil strata to the soil, where it becomes fixed and is only removable by cropping or feeding off, but not, in normal soils, by leaching. The subsoil may be richer in other mineral foods such as potash and lime, but is always poorer in nitrogen. As regards physical composition or texture the soil in temperate climates is usually poorer in the finer particles than the subsoil; that is to say, the finer portions of the soil, such as those classified as silts and clay, are gradually washed down into the lower strata and become caught in the subsoil or carried into drains and ditches in the run off. This effect tends to be balanced in old pastures by the influence of worms bringing fine soil to the surface, and, on the contrary, is increased in garden-soils by constant cultivation.

As life flourished in and on the surface soil long before it was cultivated or "broken in," the remains of all forms of bacteria, diatoms, infusors, and other microscopic plants and animals, together with macroscopic animals such as worms and other forms of animal life, decayed in the soil, while the remains of the higher plants decaying darkened the soil in colour. These processes greatly increase the nitrogenous contents and provide that most valuable form of organic matter which is universally known by the indefinable term "humus."

As has been stated before in these articles, the recent volcanic air-distributed types of soil and subsoil of Rotorua County differ fundamentally from other soils. On the physical side they differ in (1) method of distribution, (2) comparative youth, (3) comparative absence of colloids or jelly-like substances such as clay and humus, and (4) extreme porosity and looseness of texture, the individual particles also being extremely porous. They have also the unusual feature that the surface soil, as a rule, is finer in texture than the subsoil, which latter increases in coarseness with increasing depth, contrary to what is usually found in normal agricultural soils.

On the chemical side these recent volcanic soils (so recently formed from the parent acid igneous rocks, rhyolite or rhyolitic pumice or tuff), exhibit the defects in chemical composition inherent to a soil derived from an acidic parent rock. Thus they (1) are deficient in bases, except potash, manganese, and possibly copper, which appear to be present in amounts exceeding those of ordinary soils; (2) contain an excess of acidic mineral compounds, especially silica (or silicic acid) as a solid and in solution in the soil water; (3) are deficient in organic matter and clay components.

Under (1) it is fortunate that carbonate of lime is absent from these coarse pumice soils, the sandy silts, and the fine gravelly and sandy types of pumice, for it has been amply proved that the application of ground limestone to these soils has a deleterious effect on the feeding-value of the pasture, judged by the actual effects on ruminants. Stock became "bush sick" within a shorter period on a limed paddock than those pastured on the control area which had received no manurial or lime top-dressing. The writer would earnestly warn any who may contemplate applying quicklime or carbonate of lime (ground limestone) to pastures on the coarse pumice "bush sick" soils of the types mentioned that such treatment may hasten the onset of the malnutrition disease in their stock. If calcium applications, additional to those supplied in the usual phosphate fertilizers, are deemed necessary,



FIG. 1. RAUPO (*TYPHA AUGUSTIFOLIA*) SWAMP NEAR TE NGAE.

Excess of water here has resulted in the formation of deep deposits of organic matter. A comparatively recent layer of air-borne volcanic ash now forms the immediate subsoil, and facilitates drainage when the main drain is cut to remove excess of water in the lower subsoil strata.



FIG. 2. SECTION OF PUMICE SOIL AND SUBSOIL STRATA, 9 FT. DEEP, IN QUARRY AT ROTORUA.

Here may be seen manganese and iron oxides leached out of the finer upper layer of soil and subsoil into the coarser subsoil stratum at the foot of the section.

[Photos by E. C. Aston.]

the extra calcium should be applied in a non-alkaline form such as gypsum or land-plaster (hydrated sulphate of lime). This mixes well with either sulphate of iron, superphosphate, or both. Superphosphate contains a large proportion of sulphate of lime (60 per cent.), and its application to pumice lands is always beneficial.

The influence of the subsoil on the soil is paramount, for the texture of the subsoil strata determines the water content of the soil, which is one of the great factors in soil-fertility. For every type of soil there is an optimum content of water, which is greater or less according to the structure of each type. Thus quartz sandy soils require the least water, loams more, clays still more, and organic soils, peats, &c., the most water. As the water content is greater or less than the optimum, so is the response of the vegetation or crop in the quality and quantity of its growth. With increasing deficiency of water the final stage is barrenness due to drought, and desert conditions then prevail. With increasing excess of water marshy or stagnant conditions ultimately occur, inhibiting the growth of anything but plants specially adapted to withstand stagnant moist conditions.

Dehérain laid down the following rules by which can be predicted the influence of the subsoil on the soil.

(1) In a light soil with a permeable subsoil the results are entirely dependent on climate. If this be dry the soil may be extremely sterile. If the precipitation from the atmosphere be abundant or the soil be irrigated, tall vegetation will be supported.

(2) In a light soil with an impermeable subsoil the results are variable in a moderately moist climate according to the facility for natural drainage, the fertility depending on the slope. If the water can drain away, the land is fertile. When the soil is level the marshy conditions induced may render the soil useless.

(3) In a heavy soil with a permeable subsoil the excess of water readily drains away, and the land as a rule is fertile.

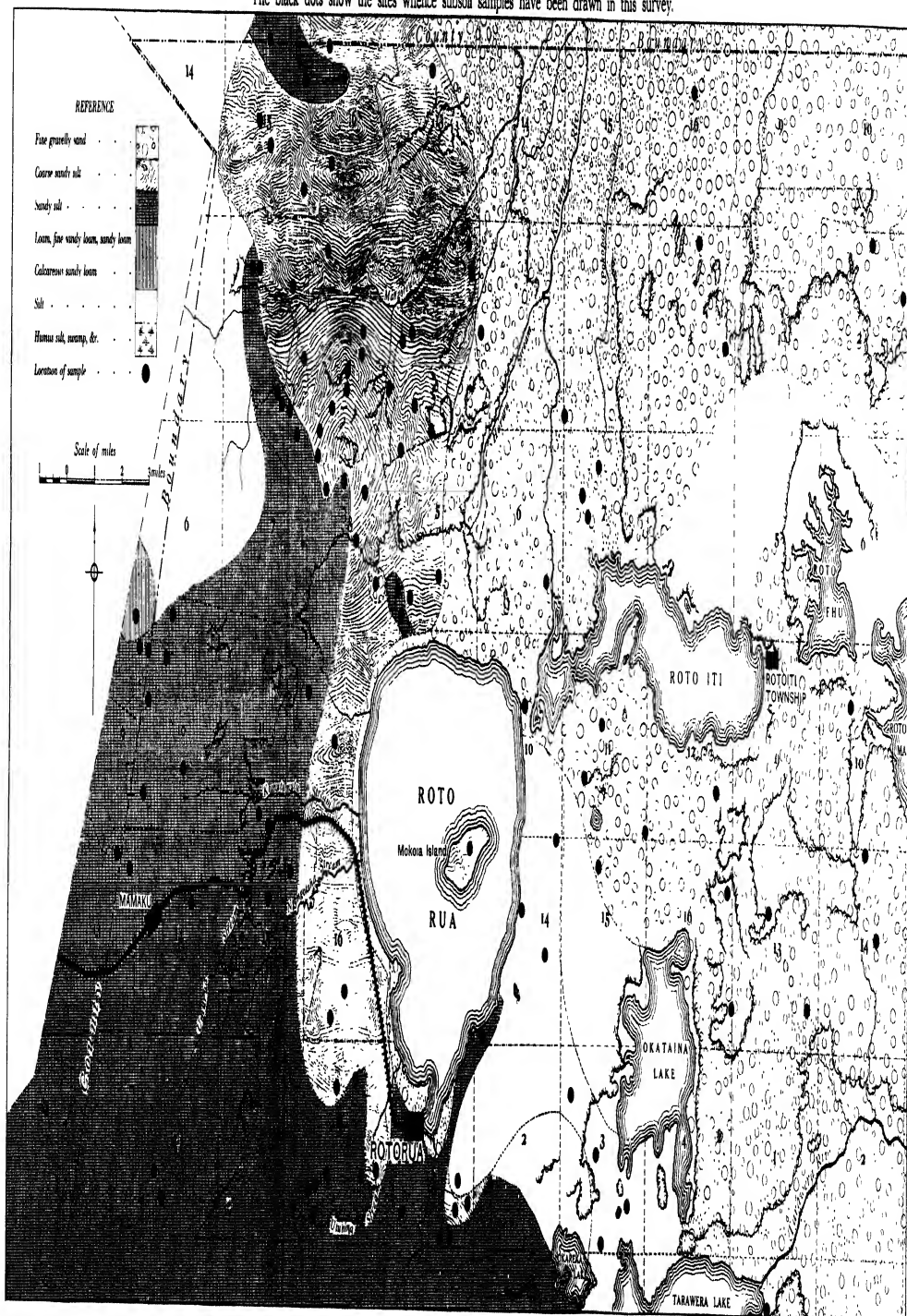
(4) In a heavy soil with a heavy subsoil marshy vegetation is produced, and the land must be drained before cultivation can succeed.

Broadly speaking, therefore, the more opposed are the characters of the soil and subsoil the more favourable it is to the plant grown on the soil. For example, heavy soils benefit by light subsoils and *vice versa*. Hard-pans, plough-soles, and other impermeable layers near the surface provide other instances of the great influence of subsoil on the soil. Extensive areas of flat land in parts of the Nelson and Westland Districts known as "pakihi" give one of the best examples of the effects of pan. (See this *Journal* for June, 1910, August, 1912, and September, 1913). It is true that cultivation, drainage, and liming will overcome to a great extent adverse subsoil conditions due to impermeability. Where there are both permeable soil and permeable subsoil the ill effects of excessive drainage, with its attendant droughtiness, may be modified by an exceedingly heavy and well-distributed rainfall or by green-manuring.

At Rotorua, however, we have a very interesting apparent exception to Dehérain's rule, where swampy conditions follow a soil originally permeable on a subsoil originally impermeable—for here, owing to the watertable being so near the surface, marshy conditions result. This may be partly due to the quick growth of the lower aquatic

MAP OF NORTHERN PART OF ROTORUA COUNTY, SHOWING DIFFERENT TYPES OF SUBSOIL.

The black dots show the sites whence subsoil samples have been drawn in this survey.



plants (algæ, &c.), bog mosses (sphagnum), the rise and fall of the Lake, and the banking-up of the copious rainfall. If pumice be kept moist enough for any length of time, under favourable conditions there results a slimy growth of lower plant-life, itself forming a non-permeable layer.

Each swamp or bog may have varying physical features operating to produce the result, but the fact remains that in the very large area of flat land of great potential value round Lake Rotorua, where both soil and subsoil strata were extremely porous, swamps are common, and usually must be drained before pasture can be successfully grown. The rise and fall of the Lake and the banking back of the heavy atmospheric precipitation has resulted in the production of grazing on coarse pumice saturated with water, and at favourable times yielding a highly nutritive fodder, although consisting mostly of weeds, Yorkshire fog, and sedges.

WEIGHT OF SOIL AS AN INDICATION OF POROSITY.

The weight of a given volume of soil is a valuable indication of the porosity of that soil. A number of weighings of $\frac{1}{8}$ cubic foot of soil were made in various localities of Rotorua district and the results calculated are as follows:—

	<i>West of Lake.</i>			Weight of Wet Soil per Cubic Foot.
Mamaku Demonstration Farm	75.47 lb.
Mamaku	70.30 lb.
Mamaku, Kaharoa clearing	70.30 lb.
Mamaku, Steele's old mill	69.30 lb.
Mamaku Demonstration Farm, unploughed	62.75 lb.
Oteroa	69.20 lb.
Oteroa, unploughed	78.30 lb.
Oteroa, ploughed	73.80 lb.
Oteroa, ploughed	75.40 lb.
Hamurana --				
Oteroa Road, ploughed	68.30 lb.
Hamurana Terrace, ploughed	77.80 lb.
Ngongotaha Lakeside	69.60 lb.
	<i>North of Lake.</i>			
Matai Road, unploughed	73.40 lb.
Matai Road, subsoil	81.70 lb.
Half-way House, Tauranga Road, ploughed	85.20 lb.
Kapakapa Road (sick), unploughed	75.10 lb.
Kapakapa Road (healthy), ploughed	85.20 lb.
Kapakapa Road (sick), unploughed	68.70 lb.
Kaharoa Road (end)	75.10 lb.
Kaharoa Road (entrance)	75.10 lb.
Paengaroa, ploughed	71.30 lb.
	<i>East of Lake.</i>			
Te Ngae (January), ploughed	98.60 lb.
Te Ngae (April), ploughed	83.30 lb.
Rotoiti (January), ploughed	77.80 lb.
Te Ngae, ploughed	98.50 lb.
Green Lake, unploughed	89.54 lb.
			(Dry weight,	66.46 lb.)
Tikitere, ploughed	88.20 lb.
	<i>South of Lake.</i>			
Rainbow Mountain, unploughed	85.30 lb.
Whakarewarewa, unploughed	73.55 lb.
			(Dry weight,	50.30 lb.)

Compared with the first 9 in. of English typical soils, the following particulars are of interest, the weights given being also per cubic foot:—

			Wet	Dry.
Old pasture, Rothamsted (loam)	..	..	100.8 lb.	71.3 lb.
Arable land, Rothamsted	..	..	100.7 lb.	89.4 lb.
Arable land, Woburn (sandy soil)	..	..	117.4 lb.	96.6 lb.

It will be seen that all the soils from the areas on the western side of the Lake, particularly those at Mamaku and Kaharoa, are very light weight compared with the English soils cited, whereas those good "healthy" soils on the east side approach more nearly the English weights, except the Rotoiti soil, where the land is unhealthy for sheep only and may be therefore classed as slightly "sick."

This method of comparative weights is one which will be developed in the field, as it appears to offer an additional means of comparing soils of light texture.

THE SUBSOIL MAP.

Comparing the subsoil map of Rotorua County here presented* with the soil map published in this *Journal* for June, 1926, it will be seen that most of the sandy silt type of soil typical of a very large area from Mamaku to the edge of the Lake is superimposed on 9 in. of subsoil having the same texture. There is, however, a strip of coarser material, two or three miles wide and designated a coarse sandy silt, underlying the sandy silt soil and having its eastern margin almost conterminous with that of the Lake's western shore. This same subsoil underlies a large area of mixed types to the north of the Lake the soil of which is fine and coarse sandy silts and fine gravelly sands. To the north, north-east, and east of the Lake the subsoil is nearly wholly fine gravelly sand, but a very large area of fertile, undulating sheep and cattle country lying between Tarawera, Okataina, and Okareka Lakes is underlain by silt subsoil with a topsoil of calcareous loam. This is the most fertile area round Rotorua Lake, and it is puzzling to an agricultural chemist why all this type is not taken up and highly farmed.

* Northern part; the southern part will be published with the next article of the series.

NOTE.—In connection with the soil-survey work here dealt with, acknowledgements are made as follows: Samples collected by R. E. Grimmett; mechanical analyses made by F. J. A. Brogan; map plotted by F. T. Leighton. The weighings of volume weights were done by the writer.

(To be continued.)

Experimental Work on Export Fruit.—At the April meeting of the Research Council the Chairman reported on this subject: "Regular experimental shipments of fruit (apples and pears) have been forwarded by vessels leaving for the United Kingdom. The fruit has been collected by Mr. M. Davey, of the Department of Agriculture, from the Nelson and Hawke's Bay districts. Dr. Barnett has arranged for the placing of thermographs in the various consignments, and has had the co-operation of the Fruit Board and Harbour Board staffs. These shipments will be examined on arrival in Britain by the staff of the Low Temperature Research Station, Cambridge, and, judging by the report on last year's fruit shipments, very valuable information should be forthcoming."

TEMPORARY STERILITY OF DAIRY COWS.

PRACTICAL POINTS FOR FARMERS.

Live-stock Division.

THE condition generally known as temporary sterility of dairy cows is a cause of considerable loss and trouble to farmers in New Zealand and in all other dairying countries. In females of all types of animals, including cattle, there are always some who, through individual idiosyncrasy, will not breed regularly or not breed at all. This temporary form occurs so frequently that it raises a perplexing problem. Cows exhibiting it will almost invariably get in calf at times varying usually from two to four months from the time of the first unsuccessful service; hence there can be no permanent defect in the generative organs of the animals, though there is evidently some cause or causes operating which prevent conception taking place at the time of the first or second service.

Intensive research aimed at determining how the trouble comes about and how it can best be combated is in progress in this country, in America, Britain, Denmark, and other countries on the Continent of Europe. Meanwhile, all the knowledge we have available must be applied to the problem of reducing the number of cases of temporary sterility to as low a proportion as possible.

Management and Treatment of the Bull.

In examining the position the degree to which the bull may be responsible for cows failing to hold must be fully considered, and there is good reason for believing that the adoption of the best methods of management of the bull will be of definite value. Points in such management are as follows :—

(1) Never let the bull run with the herd, but keep him apart in an enclosure where adequate shelter is provided. Take each cow to him for service only when she is ready. Let her have two services, and then take her back to the paddock. This enables the bull to conserve his energy, instead of wasting it in unnecessary services and perhaps (especially in the case of a very young bull) rendering himself temporarily useless from time to time.

(2) Do not allow the bull to be too fat and "soft" when the time for service arrives. He needs to be in really good condition, but this can be overdone at the expense of the sustained energy and vitality necessary for the effective carrying-out of his season's work.

(3) If a bull aged eighteen months or thereabouts is used, do not overwork him by giving him too many cows to serve.

(4) Examine the bull's organ carefully before the season commences, in order to be satisfied that it is perfectly clean and healthy. Also examine it at frequent intervals afterwards. If it is not healthy, treatment must be applied at once. The form of treatment depends on the nature of the trouble affecting it, and, wherever possible, the advice of a Veterinarian or Stock Inspector should be sought. If this is not immediately available it is a good practice meanwhile to syringe into

the sheath twice daily a mild solution of ordinary table salt. This should be prepared as follows: Boil 1 quart of water to sterilize it, and add $\frac{1}{4}$ oz. salt. Allow the fluid to cool to blood-heat, and then inject it gently into the sheath, the opening of the sheath being at the same time held as closely as possible round the injection tube so that the fluid does not escape too quickly. Skilled advice should be obtained on the spot as soon as possible, so that, if necessary, more specialized treatment, according to the exact nature of the affection, may be applied. But the salt solution is a good standby for the farmer until he can secure this advice.

(5) A bull with any diseased condition of his penis should never be allowed contact with any cow.

Management and Treatment of the Cow.

The modern dairy cow, especially if milking heavily over a full season, is subjected to a steady call upon her system which is far in excess of what would be the case were she living and rearing her calf under natural conditions. There is an intimate association between the functions of milk-production and the functions of procreation. Hence it is not difficult to realize that the dairy cow is liable to fail to respond always in a natural way to the requirements of the farmer as to getting in calf quickly, after she has concluded a season's hard work in milk-production and has commenced another. It is necessary, however, in the interests of the dairy industry to do all that is necessary in the light of our present knowledge to get cows to hold at the time required, and the following points should therefore be carefully observed :—

(1) Examine the passage of each cow as carefully as circumstances permit, in order to determine whether there is any indication of an inflammatory condition or whether any discharge is present. If either is the case, do not put the cow to the bull until the trouble has ceased, and if possible get skilled advice on the spot regarding the treatment necessary to bring about recovery. Pending this, the passage should be gently washed out once or twice daily either with the salt solution recommended for the treatment of the bull or with a very weak solution of permanganate of potash. A cow with any discharge from the passage should be isolated from the rest of the herd until the discharge has completely ceased. This is an important matter of general sanitary precaution. Vaginitis (an inflamed condition of the membranes of the vagina) is a disease frequently met with in this country, and has often been regarded as the chief cause of cows failing to hold to the bull. While such a conclusion, more especially in acute cases, cannot be ruled out, our investigations have failed to show that this is always the case, and it would appear that vaginitis is only a minor factor in temporary sterility.

(2) At the time when it is desired to put cows to the bull, graze them on paddocks where the feed is fresh and sweet, and free from rankness or roughage. This will assist in maintaining normal conditions of bodily health, and prevent digestive disturbances which may react on the nervous system, and through it upon the generative system.

(3) Any cow that has aborted or has retained the cleansing longer than is normal, or has shown a discharge from the vagina for a time

after calving and cleansing, should be at the time washed out once or twice daily with a mild antiseptic solution until the discharge ceases. The other parts also should be washed with the same solution. In addition to this, she should be washed out with the salt solution already described once daily for a week before she is expected to be ready to go to the bull. It is also a good practice to give such a cow—or, for that matter, all cows in good health and condition—two doses of laxative medicine at intervals of four days before service. Epsom salts, 12 oz. dissolved in $1\frac{1}{2}$ pints of warm water or thin gruel, will answer this purpose admirably.

(4) When a cow fails to hold to her first service two courses are open to the farmer. One is to allow her to miss the next period of heat, and try her again when the following period occurs. This often results successfully. The other course is to try her again at the next period, and if this is adopted it will certainly be advisable to give her a dose of laxative medicine two or three days before service, as advised in paragraph (3). Care should be taken to graze her on the best and cleanest pasture available. The practice of washing out the vaginal passage is largely adopted, and, provided mild and suitable liquid solutions are used, no harm is likely to result, and some good may be done in individual cases. The salt solution already mentioned is safe and useful, and the same applies to a very weak solution of potassium permanganate.

General.

On account of the trouble experienced it has become quite a common practice to let a cow miss a complete season when she has failed to hold to her first service. When this is done she almost invariably holds when she is later put to the bull. This, however, means a loss, and what is desired is to get as many cows as possible in calf at the proper time. Hence farmers are advised to adopt, as fully as they can, the methods which have been described here.

It may be added that, apart from the exact and extensive research which is being carried out, the Department of Agriculture has been conducting this season a number of experiments with foods, soil treatment, and special forms of medicinal treatment. The results of these experiments will be made known when the work is completed.

POISONING OF SMALL BIRDS WITH STRYCHNINED WHEAT.

THE following recipe and directions for the poisoning of small birds (when circumstances compel such a course) are contributed by Mr. J. C. Neill, of the Plant Research Station, Palmerston North, who vouches for the efficacy of the method:—

Recipe: (1) Mix two tablespoonfuls of sugar with two tablespoonfuls of water; (2) thoroughly mix this syrup with 12 lb. of wheat; (3) sprinkle 2 oz. of strychnine over the wheat while stirring vigorously. (Larger or smaller amounts in corresponding proportions.) Procedure: Scatter unpoisoned wheat over the ground for two or three days at about the same hour each day; then, at the same hour on the following day, scatter the poisoned wheat.

MINERAL CONTENTS OF SOME TYPICAL PASTURES IN WAIMEA COUNTY.

T. RIGG and H. O. ASKEW, Division of Agriculture, Cawthron Institute, Nelson.

Introduction.

THE work of J. B. Orr and his colleagues at the Rowett Institute has directed attention to the great importance of the mineral constituents in grass pasture in maintaining health and in producing optimum results from grazing-animals. These workers have shown that a deficiency of one or more minerals may be responsible for high mortality in stock, and that a lack of balance in the proportions of the mineral constituents of pasture frequently accounts for the inferior results in the fattening-qualities of particular pastures.

Much work on somewhat similar lines has been done in South Africa, where great deficiency of phosphate has been shown to be the initial cause of heavy losses in stock grazing on the veld.

In New Zealand B. C. Aston and his co-workers have shown that a deficiency of iron is the cause of "bush sickness" in the Rotorua district⁽¹⁾, and that a deficiency of lime in the Mairoa pastures is responsible for the poor results which have been obtained by many farmers in the latter district in recent years⁽²⁾. More recently a deficiency of phosphate in both pasture and soil has been shown to be associated with "Waihi disease," and with unsatisfactory results from dairy cows on certain Wairarapa pastures⁽³⁾.

Owing to soil-erosion, and the continual loss of minerals from the soil by the leaching-action of rain and by the grazing of stock, a great reduction in the mineral supply of the soil must have taken place over large areas of New Zealand pastures during the last forty years. It is true that lime and phosphate are now being used more extensively for top-dressing, but millions of acres of less accessible pasture-land have not so far received any treatment. It is well known that a great deterioration in many hill pastures has occurred during the last twenty years. This has not only resulted in a greatly reduced carrying-capacity of such pastures, but the health of the stock also has frequently suffered and farmers fail to obtain the returns per head of stock which they formerly secured when the land had a higher carrying-capacity.

The results obtained by B. C. Aston in connection with the Mairoa and Wairarapa pastures point clearly to the existence of mineral deficiency on a widespread scale throughout New Zealand. Many pastures which at the present time are not associated with loss in stock must be near the borderline of mineral deficiency, and, within the next ten years, unless steps are taken to supply the deficient minerals, will probably give as poor results to their owners as the deficient pastures in the Mairoa and Wairarapa districts.

(1) Trans. N.Z. Inst., vol. 55, 1924, p. 720-23.

(2) Trans. N.Z. Inst., vol. 59, 1928, p. 406.

(3) Trans. N.Z. Inst., vol. 59, 1928, p. 650.

The facts which have been elicited by Aston and his co-workers point clearly to a close connection between soil properties and the mineral supply of the pastures. The data which have been obtained both on soil and pasture grass should prove valuable as standards for comparison in diagnosing deficiencies in other pastures.

With a view to the collection of additional data concerning the mineral status of New Zealand pastures, a systematic examination of the mineral constituents in the pastures of Waimea County, Nelson, was undertaken by the Cawthron Institute. Owing to the varied geology of the Nelson District great variation in soil-properties occurs within a limited area, and it was anticipated that a corresponding variation in the mineral constituents of the pastures would be revealed. Furthermore, high mortality in stock and unsatisfactory results from stock were known to occur in several localities, and it was thought that the analyses of pasture-samples would point clearly to the causes for both good and poor results secured by farmers.

It was hoped that the analytical data thus accumulated would be not only valuable to the Nelson District in suggesting methods for the improvement of pastures, but would also serve as standards of comparison for other pastures in New Zealand located on similar soil-types under somewhat similar climatic conditions.

COLLECTION OF SAMPLES.

The soil map of Waimea County prepared by Messrs. T. Rigg and J. A. Bruce was used as a basis in the selection of pastures typical of various soil-types in the county. In sampling the pastures care was taken to secure only green growth, so that a comparison could be made of the mineral status of the pasture at the same stage of growth development in each case. A series of samples representative of the pastures associated with the more important soil-types was collected during April after the autumn rains had brought the grass away. The autumn and summer of 1928 were very dry, and on the hill pastures practically no growth was made until after heavy rains at the beginning of April. In a number of instances samples of hill pastures were collected from areas which had been burnt over during the summer. This made the work of collecting green growth uncontaminated with mature grass comparatively easy, but on the other hand the analyses of the grass so collected probably represent the optimum mineral content of these pastures.

Although it has not been possible to complete the analyses of all the samples, sufficient have been finished to demonstrate the nature of the variations in the mineral supply of typical pastures representative of some of the more important soil-types.

1. Hill Pastures of Waimea County.

Samples of pasture were collected during April, 1928, from six soil-types which had widely different soil characteristics. No treatment had been given the pastures, as far as could be ascertained, since their establishment decades ago. The mineral composition of the pastures should therefore reflect the natural supply of minerals in these soils of different derivation.

The soil-types chosen for the study of their associated pastures have been named in the soil classification adopted by the Cawthron Institute as follows: (1) Moutere Hills type, (2) Wakapuaka type, (3) Heslington type, (4) Orinoco type, (5) Kaiteriteri type, (6) Pikikiruna type.

In every case the name which has been given the soil-type indicates the locality where extensive areas of the soil are found.

GEOLOGICAL ORIGIN OF THE SOILS.

The Moutere Hills soil has been derived from the weathering of a vast deposit of gravels laid down in Pleistocene times. The gravels consist mainly of sandstone, claystone, and greywacke very much weathered and decomposed. The principal soil is a loam underlaid by a sandy clay. It has excellent textural qualities and is well suited to the growth of trees. Pastures on this soil-type are very poor, and frequently run less than half-sheep per acre.

The Wakapuaka soil-type is derived from the weathering of basic igneous rocks which are described by Hochstetter⁽⁴⁾ under the name "augite-porphry." Bell and others state that the rocks consist mainly of small grains of augite, together with feldspar and serpentine⁽⁴⁾. They state that they are altered olivine basalt, and use the term "melaphyre" for them. The soils derived from these rocks are loams which possess some variation in texture on different parts of the soil-type. The pastures associated with these soils are considered excellent for stock purposes and maintain at least two sheep per acre.

The Heslington soil-type is derived from the weathering of Triassic shales. The soil is a light loam, which is highly favoured by farmers for early pea and market-garden culture. When in pasture excellent results are obtained from sheep. The carrying-capacity is about one and a half sheep per acre.

The Orinoco soil-type is derived from the weathering of hornblende schists and porphyries⁽⁵⁾. The soils are usually sandy loams. The pastures associated with these soils maintain about one and a half sheep per acre, and are considered very satisfactory by stockmen.

The Kaiteriteri soil-type is derived from the weathering of granite and quartzites. There is a considerable variation in texture on different parts of the soil-type. Very poor pastures and indifferent results with stock are associated with this soil-type. The carrying-capacity is approximately half-sheep per acre.

The Pikikiruna soil-type is derived from the weathering of crystalline limestones which come to the surface on many parts of the soil-type. Excellent results with stock are obtained on this soil-type, the carrying-capacity being about one and a half sheep per acre.

CHEMICAL CHARACTERISTICS OF THE SOILS.

In Table 1 some chemical criteria in connection with the soils are set out. It will be seen that the Moutere Hills and the Kaiteriteri soil-types are outstandingly poor soils. The supply of organic matter,

⁽⁴⁾ The Geology of the Dun Mountain Subdivision. Bull. No. 12 (New Series), N.Z. Geol. Survey. By James M. Bell, E. Clarke, and P. Marshall.

⁽⁵⁾ S. H. Cox: Geology of the Riwaka Range. N.Z. Geol. Reports, 1879-80.

Table 1.—Sundry Chemical Characteristics of the Soils.^a

	Moutere Hills.	Wakapu-aka.	Hesling-ton.	Orinoco.	Kaiteri-teri.	Pikikiruna.
Loss on ignition ..	6.10	10.90	9.50	17.10	7.05	11.90
Total nitrogen ..	0.10	0.26	0.24	0.42	0.10	0.40
Soluble in 1 per cent. citric acid—						
Available phosphoric acid, P_2O_5	0.003	0.004	0.029	0.067	0.003	0.018
Available potash, K_2O	0.007	0.017	0.037	0.015	0.009	0.029
Lime-requirement figure	0.32	0.15	0.13	0.40	0.27	0.16

NOTES.—With the exception of the Pikikiruna soil, a number of samples representative of each type have been analysed. The figures quoted above are the averages for each set of samples.

All data from Table 1 are adopted from unpublished records of the soil survey of Waimea County.

nitrogen, and phosphate are all low. Both soils are markedly acid in reaction, and little improvement in crop-production is obtained without the use of both lime and phosphate. The Wakapuaka soil-type is also low in available phosphate, but the amount extracted with hydrochloric acid from this soil is almost normal—0.09 per cent. P_2O_5 , against 0.025 per cent. P_2O_5 in the Moutere Hills type. The Orinoco soil-type is outstandingly high in phosphoric acid. It has a marked acid reaction, but it probably has a fair supply of easily replaceable lime. The Pikikiruna and Heslington types are well supplied with phosphate, and together with the Wakapuaka type have comparatively low lime-requirement figures.

NOTES ON THE BOTANICAL COMPOSITION OF THE PASTURES.

The dominant species of the Moutere Hills and Kaiteriteri pastures are *Agrostis* sp. and danthonia. Clovers, and indeed leguminous plants, are present in exceedingly small proportions in the pastures sampled. The dominant species of the Heslington pasture is danthonia, with some perennial rye-grass, fescue, trefoil, and agrostis.

In the case of the Orinoco pastures the more important species are danthonia, trefoil, and white clover, with some fescue, varrow, and agrostis.

The Wakapuaka pasture-samples consist mainly of perennial rye-grass, *Poa pratensis*, fescue, and some white clover. White clover is an important constituent of this pasture, but owing to its short growth at the time of sampling little was included in the samples analysed.

The Pikikiruna pasture-sample consists mainly of danthonia, perennial rye-grass, white clover, and trefoil.

ANALYSIS OF THE HILL PASTURES.

The analytical data in connection with the pastures given in Table 2 represent the average for two or more samples from each soil.

The poor qualities of the Moutere Hills and Kaiteriteri soil-types are reflected in the mineral composition of the pastures associated

with them. The low content of soluble ash, phosphate, and nitrogen are characteristic features of the analyses of these pasture-samples. Both pasture-types contain a low percentage of iron and a high percentage of manganese. A somewhat similar relationship between iron and manganese has been noted by Grimmett and Simpson⁽⁶⁾ in the case of the "pining" pastures of Scotland. The percentage of lime in the Moutere Hills and Kaiteriteri pastures is very low, but the pastures on some of the better soil-types have also a comparatively low percentage of lime.

Table 2.—Analyses of General Pasture Samples from Hill Soil-types.

			Moutere Hills (Pleistocene Gravels).	Wakapuaka* (Basic Igneous Rocks).	Heslington (Triassic Shales).	Orinoco (Hornblende Gneiss).	Kaiteriteri (Granite)	Pikikiruna (Limestone).	English Hill Pastures† (partly grazed).
Lime	CaO	..	0.61	0.54	0.64	0.82	0.56	0.98	0.56
Phosphoric acid	P ₂ O ₅	..	0.63	0.85	0.95	0.94	0.64	0.95	0.60
Potash	K ₂ O	..	3.19	4.21	3.63	4.44	2.93	4.02	2.60
Sodium oxide	Na ₂ O	..	0.12	0.21	0.26	0.12	0.19	0.26	0.41
Chlorine	Cl	..	1.07	1.64	1.18	1.54	1.00	1.03	0.60
Nitrogen	N	..	3.43	5.08	5.00	4.92	3.32	5.02	2.54
Sulphur	S	..	0.33	0.33	0.33	0.35	0.24	0.35	..
Iron	Fe	..	0.011	0.043	0.025	0.045	0.016	0.016	..
Manganese	Mn	..	0.052	0.022	0.018	0.038	0.042	0.018	..
Total ash		..	11.67	11.31	11.15	12.07	10.63	11.11	7.46
Soluble ash		..	6.15	8.17	7.33	8.70	5.99	8.25	5.49
Insoluble ash		..	5.52	3.14	3.82	3.37	4.64	2.86	1.97

* White clover is an important constituent of this pasture. Owing to the short growth little clover was included in the samples collected for analysis. The lime content is therefore considerably lower than might have been expected.

† W. B. Godden. Jour. Agric. Sci., 1926, vol. 16, pt. 1, p. 81.

NOTES.—All determinations are expressed as percentages of dry matter.

All Nelson samples represent young green growth collected in autumn, 1928.

The Pikikiruna and Orinoco samples contain exceptionally high percentages of lime and phosphate for untreated hill-pastures. The percentages of soluble ash and nitrogen in these pastures compare favourably with those of top-dressed pastures on the alluvial flats. One sample from the Pikikiruna soil-type contained only 0.010 per cent. of iron. This approaches closely the percentage of iron found by Aston⁽⁷⁾ on pastures affected with "bush sickness." Symptoms of "bush sickness," however, have not been observed on the Pikikiruna pastures, which are noted for their excellent qualities.

The Heslington and Wakapuaka pastures fall into an intermediate group. They both have a high content of soluble ash, nitrogen, and phosphate, but the percentage of lime is low. This can be partly explained by the small amount of leguminous plants contained in the samples analysed. In the case of the Wakapuaka sample the lime content as revealed by the analyses is probably considerably below the average lime-content of this pasture for the whole season. Both pasture-types are well supplied with iron, and there is a normal ratio between iron and manganese.

(6) N.Z. Inst. Trans., vol. 59, 1928, p. 401.

(7) N.Z. Jour. Agric., vol. 36, No. 2, p. 80.

In comparison with the average mineral content of partly grazed hill-pastures in Great Britain⁽⁸⁾, there is a fairly close resemblance in the case of the Moutere Hills and Kaiteriteri pastures. The other types have much higher figures for their mineral constituents. The nitrogen and chlorine contents of the Nelson pastures are much higher than in the hill pastures examined by Godden. There does not appear to be as close a correlation between the chemical criteria of the soils and the mineral contents of the pastures as might have been expected. The soil-types abnormally low in phosphate are associated with pastures containing low amounts of phosphate, but when the amount of phosphate in the soil rises above a certain figure comparatively little difference is shown in the phosphate content of the pastures. The lime-requirement figure as a measure of lime deficiency in the pasture is not very satisfactory. It is probable that a much closer correlation exists between replaceable bases in the soil and the mineral supply of the pastures. The chemical criteria of the soil-types show more relationship between a wider flora range and carrying-capacity per acre than with the actual mineral content of the pastures.

2. Pastures of the Alluvial Flats.

Owing to the varied geology of the Nelson District there is great variation in the parent material from which different alluvial soils have been derived. Some of the alluvial soils are extraordinarily fertile, and in cases show little drop in production even after forty years of continuous grazing by stock, while others are noted for their infertility and their poor pastures. The analyses of pasture-samples from the alluvial soils are shown in Tables 3 and 4.

In the case of the pastures included in Table 3, stockmen speak highly of them, and in many cases they are noted for their milk-producing or fattening qualities. Sample No. 1 is from the dairying pastures of Richmond, and with the exception of a little oats, hay, and roots fed on the field the land has had no manurial treatment for many years. It is located on a stony loam well supplied with organic matter and containing a moderate supply of available plant-food. For the last seven years it has been shut up for hay and grazed during the rest of the year. The pasture has a mixed flora of perennial rye-grass, timothy, cocksfoot, fog, sweet vernal, trefoil, and clover. Despite the fact that artificial fertilizers have not been used the mineral content of the pasture remains at a high level.

Sample No. 7 was collected from the highly fertile Riwaka loam, which is noted for its excellent textural qualities and its high content of plant-food. Samples of soil from this type frequently contain 0.1 per cent. available phosphoric acid. The dominant species in the pasture are perennial rye-grass and white clover. The phosphoric-acid content of this pasture is amazingly high when compared with the average content of typical cultivated English pastures analysed by Godden⁽⁸⁾. On the assumption that such a pasture produces during the growing-season 3 tons per acre of dry grass in the young-growth

(8) Jour. Agric. Sci., 1926, vol. 16, pt. 1, p. 81.

Table 3.—Analyses of Pasture Samples from Different Soil-types giving Good Results with Stock.

		Laboratory No.								Average for Eight Samples.	Average English Cultivated Pastures.*
		1.	7.	8.	13.	18.	25.	27.	59.		
Lime	CaO	0.74	0.96	0.66	1.10	0.61	0.66	0.82	1.07	0.83	1.00
Phosphoric acid	P ₂ O ₅	0.90	1.29	0.96	1.04	0.94	1.08	1.09	1.18	1.06	0.74
Potash	K ₂ O	3.79	3.47	3.92	4.42	3.30	3.94	4.54	4.34	3.96	3.18
Sodium oxide	Na ₂ O	0.58	0.65	0.31	0.36	0.69	0.46	0.35	0.52	0.49	0.25
Chlorine	Cl	1.21	1.36	1.17	1.62	1.51	1.61	1.61	1.51	1.45	0.95
Nitrogen	N	5.39	5.10	4.79	5.75	5.49	5.04	5.54	5.66	5.34	2.83
Sulphur	S	0.47	0.32	0.36	0.39	0.54	0.48	0.44	0.44	0.43	..
Iron	Fe	..	0.014	0.053	0.020	0.032	0.013	0.040	0.059	0.033	..
Manganese	Mn	..	0.016	0.021	0.040	0.008	0.012	0.014	0.008	0.017	..
Total ash	..	10.91	10.83	11.36	13.21	11.69	10.45	12.34	12.71	11.69	9.79
Soluble ash	..	8.71	8.71	8.27	10.10	8.90	9.09	9.27	9.72	9.10	6.64
Insoluble ash	..	2.20	2.12	3.09	3.11	2.79	1.36	3.07	2.99	2.59	3.15

* Analyses by W. Godden. Jour. Agric. Sci., 1926, vol. 16, pt. 1, p. 81.

NOTE.—All Nelson determinations made on green autumn growth and expressed as percentages of dry matter.

stage, no less a quantity than approximately 4 cwt. equivalent of superphosphate per acre is taken up by the grasses and clovers.

Sample No. 8 is taken from an untreated pasture which has been down many years. The pasture is located on a very fertile sandy loam at Umukuri. The soil has a very high content of available phosphoric acid, but has a markedly acid reaction. The main constituents of the pasture are perennial rye-grass and white clover.

Sample No. 13 is taken from a more recently established pasture on a soil made by the re-sorting of the Moutere Hill detritus. Liming at the rate of 2 tons of ground limestone per acre and regular phosphatic manuring have been the secret of success in establishing a first-class pasture on a comparatively poor soil. The dominant constituents of the pasture are perennial rye-grass and white clover. The influence of heavy liming is clearly seen in the high lime content of the sample analysed. Formerly the owner had difficulty in fattening lambs and secured only a 40-per-cent. increase in his flock. Since the establishment of good pasture, using lime and phosphate, he has averaged 90 per cent. of lambs. Lambs running with their mothers on this pasture have attained a dressed weight of 68 lb. in less than five months.

Sample No. 27 was collected from a pasture which has been established for four years. The pasture is located on better-quality Moutere Hills soil. Two tons of ground limestone per acre and a liberal application of phosphate were used in the establishment of the pasture. The pasture has been regularly top-dressed with superphosphate. The pasture contains perennial rye-grass, white clover, and cocksfoot as the dominant species. Formerly the land carried indifferently less than one sheep per acre, but since the establishment of the good pasture four sheep per acre have been maintained, with great improvement in the condition of the stock.

Sample No. 18 was collected from a top-dressed pasture on a heavy loam. At the time of establishment four years ago 1 ton of ground limestone per acre was applied to the land. The pasture is regularly top-dressed with 2 cwt. superphosphate per acre. Perennial rye-grass, cocksfoot, and white clover are the principal constituents of the pasture. Excellent results with dairy cows are obtained by the owner.

Sample No. 25 was taken from the peat lands at Wakapuaka. The pasture is excellent for fattening stock. No treatment has been given for many years. The main constituents of the pasture are perennial rye-grass and white clover.

Sample No. 59 was collected from an excellent pasture of rye-grass and white clover situated on the alluvial flats formed by the Wakapuaka River. As far as could be ascertained no treatment has ever been applied to this pasture. Both sheep and cattle do well on it, and many fat stock are sent to the market. The soil is a light loam well supplied with organic matter, is neutral in reaction, and has no lime-requirement. It is moderately well supplied with available plant-food.

The outstanding features of the analytical data in connection with the good pastures enumerated in Table 3 are the high percentages of soluble ash and phosphoric acid. The lime content with but one exception falls considerably below the average figure given by Godden^(*) for English cultivated pastures.

The nitrogen content of all the samples is exceedingly high. Some samples contain double the amount quoted by Godden. Woodman has remarked on the high proteid value of green grass in his experiments in England, but the average content of crude proteid in the good Nelson pastures is considerably higher. Woodman^(*) found 27.92 per cent. crude proteid in the autumn cuts of a good pasture on a sandy soil. The average for crude proteid in the case of the eight samples quoted in Table 3 is 33.37 per cent. Sample No. 13, indeed, attains the remarkable figure of 35.94 per cent. crude proteid.

The analyses reveal the fact that a considerable variation in the percentages of iron and manganese may occur in the pastures without any obvious detrimental effects on stock. It must, however, be remarked that no instance occurs of an extremely low content of iron associated with a high content of manganese. The influence of liming and phosphatic manuring on the mineral contents of pasture can be readily seen in the case of a number of the analyses shown in Table 3.

Some abnormal pastures on certain alluvial soils are dealt with in Sections 3 and 4.

3. Pastures giving Poor or Indifferent Results with Stock.

The chemical data for pastures from a number of different soil-types giving unsatisfactory results with stock are tabulated in Table 4.

(a) The Moutere Hills and the Kaiteriteri pasture-types have already been discussed in Section 1. Both sets of grass-samples are low in lime, phosphoric acid, soluble ash, and nitrogen. They have a low content of iron and an abnormal iron-manganese ratio. The occurrence

(*) Jour. Agric. Sci., 1926, vol. 16, p. 228.

Table 4.—Analyses of Pasture Samples from Different Soil-types giving Poor or Indifferent Results with Stock.

			Moutere Hills.	Tahuna Fine Sand.	Kaiteriteri.	Gordon Fine Sands.	Wakapu-aka Silt.	Average for Good Pasture (Nelson).
Lime	CaO	..	0.61	0.49	0.56	0.23	0.36	0.83
Phosphoric acid	P ₂ O ₅	..	0.63	0.68	0.64	0.82	1.04	1.06
Potash	K ₂ O	..	3.10	3.38	2.93	2.80	3.33	3.96
Sodium oxide	Na ₂ O	..	0.12	0.13	0.19	0.12	1.41	0.49 *
Chlorine	Cl	..	1.07	1.17	1.00	0.77	2.91	1.45
Nitrogen	N	..	1.13	3.75	3.32	3.93	4.39	5.34
Sulphur	S	..	0.33	0.32	0.24	0.26	0.54	0.43
Iron	Fe	..	0.011	0.013	0.016	0.043	0.011	0.033
Manganese	Mn	..	0.052	0.035	0.042	0.004	0.007	0.017
Magnesia	MgO	..	..	..	..	0.96	..	0.70*
Total ash	..	..	11.67	10.87	10.63	12.69	11.69	11.69
Soluble ash	..	..	6.15	6.71	5.99	6.06	9.86	9.10
Insoluble ash	..	..	5.52	4.16	4.64	6.63	1.83	2.59

* One sample only.

NOTE.—All determinations made on autumn green growth and expressed as percentages of dry matter.

of xanthin calculi in the kidneys of sheep pastured on the Moutere Hills type will be dealt with in another paper. It is probable that xanthin calculi occur in sheep pastured on the Kaiteriteri type, but so far no case has come under our personal observation. Both pasture-types are associated in certain seasons with high mortality of sheep, particularly of hoggets.

The pastures of the Tahuna sands give unsatisfactory results with stock unless lime and phosphate treatment has been given. Sheep fail to maintain their condition, and "pica" in stock is common. Where tree-lucerne is grown it is stripped bare of foliage and bark by stock. The main constituents of the flora are *Agrostis* sp. and danthonia, with a little trefoil and fog. The chemical analysis of untreated pasture shows that it has a low feeding-value. The mineral supply is low, particularly in lime and phosphate.

(b) The pastures associated with the Gordon fine sands in a part of the Motueka Valley provide very little growth at any time of the year. But even with light stocking, stock waste rapidly away if kept too long on them.

The Gordon fine sands are derived mainly from the detritus brought down by the Motueka River from serpentinous rocks in Mineral Belt country. The soil is neutral in reaction and has no lime requirement. It is also deficient in available phosphoric acid.

The chemical data for these pastures are of great interest in view of the low fertility of the soils and the poor results with stock. The outstanding feature of the analyses is the extremely low percentage of lime. The samples are relatively high in magnesia and silica. The percentage of iron is also high, but that of manganese is correspondingly low. The results of the analyses suggest that a great deficiency of lime is the principal factor responsible for poor stock conditions.

(c) In the case of the pasture associated with the Wakapuaka silt loam, which has been reclaimed from the sea during the last twenty years, no definite facts concerning behaviour of stock on the pasture could be secured, as the animals have access to good pasture. Owing to the abnormal features revealed by the analysis it has been included in Table 4 for consideration.

The main constituents of this pasture are perennial rye-grass, trefoil, and white clover. Owing to the short growth of trefoil and white clover the sample analysed consists mainly of perennial rye-grass. The most important features of the analytical data for this pasture are the high percentages of chlorine and sodium, and the abnormally low content of both lime and iron.

4. Suspected "Bush-sick" Pastures.

Certain pastures located on granite soils in the vicinity of the Hope and Sherry Rivers are of exceptional interest. Serious losses of stock have occurred when the grazing has been restricted to some parts of the farms. The stock on such areas within a short time exhibit typical symptoms of "bush sickness." It seems probable that a very considerable tract of country is affected—possibly embracing a great part of the Kaiteiteri soil-type. Owing, however, to the narrow outcrop of the Kaiteiteri granite in other parts of the country, and to the extensive nature of the grazings, typical "bush sickness" in other parts of the district has not been reported.

Certain pastures in the vicinity of Glenhope where typical symptoms of "bush sickness" occur have been closely studied with a view to the elucidation of the problem. Owners of property in this locality state that symptoms are apparent within three weeks if sheep are grazed exclusively on affected pastures. Death of the animals frequently ensues within six to nine months from the commencement of grazing.

COLLECTION OF SAMPLES.

A number of samples from both healthy and affected pastures were collected during the autumn and spring. These samples, together with the chemical analyses, are recorded in Table 5. Samples Nos. 39 and 128 were collected from a typical hill pasture affected with "bush sickness." Nos. 40 and 129 were taken from an untreated field on the alluvial flats formed by the Hope River. These flats consist largely of detritus derived from granite country lying between Glenhope and the Sherry Valley. They are known to be affected with "bush sickness." Sample No. 40 was collected from a field on the alluvial flats which had been top-dressed in 1918 with 2 tons of ground limestone per acre. The owner of the property states that lime and phosphate treatment of the pasture accentuated the incidence of "bush sickness" in stock. Sample No. 130 was collected from a very swampy field on the alluvial flats. "Bush sickness" is said to be particularly bad on this field. Samples Nos. 131 and 132 were collected from healthy country in the vicinity of Glenhope. Sample No. 131 came from another type of granite country which has a high carrying-capacity and which gives excellent results with stock. Sample No. 132 came from the less fertile Moutere Hills country, which, however, is not associated with "bush sickness."

Table 5.—Analyses of Pasture Samples from "Bush-sick" Area, Glenhope.

			Autumn Samples.			Spring Samples			Adjoining Healthy Country (Spring Samples).	
			No. 40.	No. 41.	No. 39.*	No. 128	No. 129.	No. 130.	No. 131.	No. 132.
Lime	CaO	..	0.56	0.75	0.55	0.47	..	..	..	..
Phosphoric acid	P ₂ O ₅	..	0.71	0.94	0.47	0.70	..	..	..	..
Potash	K ₂ O	..	..	..	1.85	3.21	..	..	..	..
Sodium oxide	Na ₂ O	..	..	..	0.16	0.09	..	..	..	..
Chlorine	Cl	..	..	..	0.48	0.76	..	..	..	..
Nitrogen	N	..	..	..	1.90	3.29	..	..	..	..
Sulphur	S	..	..	..	0.14	0.31	..	..	..	..
Iron	Fe	..	0.017	0.014	0.008	0.014	0.014	0.011	0.040	0.040
Manganese	Mn	..	0.042	0.028	0.029	0.020	0.025	0.034	0.012	0.027
Total ash	..	..	..	..	8.17	8.57	..	..	..	..
Soluble ash	..	..	..	..	4.04	5.77	..	..	..	..
Insoluble ash	..	..	..	..	4.13	2.80	..	..	..	..

* This sample contained some more mature grass.

NOTE.—All determinations made on green growth and expressed as percentages of dry matter.

BOTANICAL NOTES ON THE PASTURE-SAMPLES.

In the case of the granite hill pasture—Samples Nos. 39 and 128—the dominant species is Chewings fescue. There is a good sole of grass, and plenty of feed is available. The soil has a loose porous texture, but there is a plentiful supply of moisture during most times of the year.

Samples Nos. 40 and 129 contain fescue, *Agrostis* sp., fog, and danthonia. Sample No. 41 consists mainly of white clover, cocksfoot, and danthonia. Sample No. 130 consists mainly of fog and *Agrostis* sp. Sample No. 131 contains fescue, white clover, *Lotus* sp., and cocksfoot. Sample No. 132 contains danthonia, fescue, *Agrostis* sp., and a little fog, *Lotus* sp., and white clover. With the exception of No. 39, which contains some more mature grass, all the samples consist of young green growth.

THE ANALYTICAL DATA.

The most significant feature of the analyses is the low content of iron associated with all the pasture samples collected from "bush sick" country. The low content of iron is a marked feature of both spring and autumn samples. Pasture-samples from other soil-types in the Waimea County have been characterized by a low content of iron in the autumn samples, but the spring samples have all shown greatly increased percentages⁽¹⁰⁾. Samples Nos. 131 and 132, from healthy country in the vicinity, contain nearly three times the percentage of iron found in the "bush sick" pastures. It is interesting to note that the iron content of the spring samples from reputedly "bush sick" pastures was little affected by varying moisture conditions of the soil.

With the exception of the pasture which has had lime treatment, all the samples from "bush sick" country have a low lime content. This is particularly marked in the spring sample No. 128 from the hill

⁽¹⁰⁾ Unpublished data concerning seasonal variation in the mineral contents of pasture.

country. The occurrence of "bush sickness" on the limed pasture, however, does not support the possibility of a lime deficiency being associated with "bush sickness." The analytical data confirm the results which have already been obtained by Aston⁽¹⁾ in his investigations of the "bush-sick" pastures of the Rotorua District.

Summary.

(1) Untreated pasture-samples from a number of different soil-types have shown on analysis that striking differences exist in their composition.

(2) There does not seem to be any very obvious correlation between the chemical data usually determined on soils and the mineral composition of the grass, except that abnormally low percentages of available phosphate in the soil are reflected in low percentages of phosphoric acid in the grass, while the lime-requirement figures give little information as to the probable lime content of the pasture.

(3) Judged by the standard of Godden's figures for English hill pastures, the pastures on the various Nelson hill soil-types appear to be good, since in all cases the percentages of the various constituents are somewhat higher in the Nelson series; especially is the difference remarkable in the nitrogen and total-ash and soluble-ash figures. In the poorest types of hill pastures (Moutere Hills and Kaiteriteri) the lime and phosphate contents compare closely with those given by Godden, yet it is certainly known that in the Moutere District serious stock ailments are found. The poorer pastures show low iron and high manganese contents, and are also distinguished by their high content of silica.

(4) The analyses show that the Nelson pastures considered satisfactory by stockmen differ in many respects from the English cultivated pastures analysed by Godden. In the Nelson pastures the phosphoric-acid content is in every case except one considerably higher than that of the lime, a reverse order to that found by Godden. In all cases also the potash, chlorine, nitrogen, total ash, and soluble ash are greater than Godden's average figures. The most striking result is the very high percentage of crude proteid found in these New Zealand pastures; as has been pointed out above, this far outstrips any of the available English figures, in one case reaching practically 36 per cent. The main constituents of these pastures have been perennial rye-grass and white clover, a mixture considered to be the ideal for pastures.

(5) A number of districts in the Waimea County are characterized by their poor results with stock. It is probable that a number of factors are operating, as the following considerations will show.

(a) The pastures of the Gordon fine sands have given poor results with stock, even with very light stocking. The soil is infertile, though neutral in reaction, so that only a very poor growth ensures. The low content of lime and high content of magnesia are outstanding features of the samples analysed.

(b) Samples of pasture from the Moutere Hills and the Kaiteriteri formations have been found to be low in lime, phosphoric acid, soluble ash, and nitrogen, and are distinguished from the pastures of other soil-types by the low percentage of iron and the high percentage

of manganese. On the former type of soil kidney trouble, with formation of xanthin calculi, is common.

(c) A large area of granite country in the vicinity of the Hope and Sherry Rivers is associated with definite symptoms of "bush sickness" in stock. The pasture-samples from Glenhope confirm the theory of "bush sickness" by their low contents of iron, especially in the autumn samples. The data presented show clearly the difference in the iron contents of pastures from fields known to be "sick" or "healthy." Starvation of the animals does not occur, as abundant feed is available; some of the other mineral constituents are low, but the controlling factor in the poor results obtained with stock appears to be the low iron content.

(d) The pastures of the Tahuna sands are distinguished by their leading to the development of "pica" among stock, and satisfactory results can only be obtained if lime and phosphate dressings are applied. Although all the minerals are present in low amounts the main deficiency appears to be in respect of the lime.

(e) The pastures of the Wakapuaka reclaimed area are distinguished by their low lime and iron contents and the high content of sodium and chloride. As the stock on this area have access to good pasture: no comment can be made as to the effect of this abnormal pasture on the health of the animals.

Conclusion.

In conclusion the writers express their indebtedness to Messrs. J. A. Bruce and L. Bishop for the assistance they have given in the collection of pasture-samples. The authors have drawn freely on the unpublished records of the soil survey of the Waimea County in describing the characteristic properties of the soil-types associated with the pastures discussed in this paper.

The work recorded in this paper has been carried out in connection with the Empire Marketing Board's scheme for pasture research within the Empire. The Empire Marketing Board and the New Zealand Research Council have contributed generously towards the cost of the investigation.

Wheat Research Institute.—The Chairman's report at the April meeting of the Research Council included the following reference to this activity: "Work at the Wheat Research Laboratory (Christchurch) is in full swing on investigations connected with the present season's grain. Some one thousand samples of wheats from all parts of the grain-growing districts of both Islands have been assembled at the Laboratory for physical, chemical, and baking tests. The Director's report dealing with the correct naming of a large number of varieties grown throughout Canterbury and Otago, together with the steps taken to certify good supplies of seed wheat, will help in the production of those desirable types of grain most useful to millers and bakers. Data compiled from the large area devoted this year to single-ear selections, yield trials and manurial trials, are now being worked up. Investigations concerning the use of additions such as milk products to flour used in bread-manufacture, and into causes of staleness in bread, also are being undertaken at the Laboratory.

BIOLOGICAL CONTROL OF PEAR-MIDGE (*PER- RISIA PYRI*) IN NEW ZEALAND.

THE PRESENT POSITION.

J. MUGGERIDGE, B.Sc., Fields Division, Palmerston North.

THE present article provides a brief summary of the work relating to the establishment in New Zealand of the pear-midge parasite *Misocyclops marchali* (Kieff),* including the past season of 1928-29. Proposals for the introduction of other parasites are also mentioned.

SEASON 1925-26.

The biological control of pear-midge in New Zealand commenced late in the 1925-26 season. This work was initiated by Dr. D. Miller (then Government Entomologist, but now of the Cawthron Institute), at whose instigation Dr. J. G. Myers was commissioned to make a survey of the position in France and, if possible, locate suitable parasites for despatch to New Zealand. Through Dr. Myers, and subsequently the Imperial Bureau of Entomology, consignments of the midge parasites arrived here in October, 1925. Summarizing, we find that a fair amount of this material was used for experimental purposes and liberation in the insectary in Mr. W. G. Williams's orchard at Henderson, and the remainder was liberated in the orchard.

SEASON 1926-27.

In this season further consignments of the parasites were forwarded by Dr. R. C. Fisher through the Imperial Bureau. In all five consignments arrived over a period from August to December. This material was used mainly to ensure establishment of the parasite, and subsequent events go to show that this was quite successful.

SEASON 1927-28.

No further importation of parasites was undertaken in 1927-28, since midge-infested material taken from Williams's orchard at Henderson showed conclusively that the parasite had overwintered and had apparently become successfully established.

Mr. W. Cottier, Assistant Entomologist, Department of Agriculture, was delegated to attend to midge work for part of this season. This involved mainly the distribution of parasitized material to various orchardists. A list of orchardists to whom material was sent was kept.

SEASON 1928-29.

It was felt that this season would be the critical one, and that should the parasite become effective it would now show up. The orchardists to whom parasitized material had been distributed during the summer of 1927-28 were circularized early in the season, asking them to forward midge-infested material so that we might determine whether the parasite had become established in their locality, and, if possible, also to determine the degree of parasitism. Most of those

* In previous articles in the *Journal* this insect has been referred to as *Platygaster*.

circularized responded well, and the material sent in was placed in emergence-boxes and records kept of parasites and midges. The results obtained are as recorded below :—

Emergence Box A : Material from Orchard Instructor, Hastings. About 70 midges emerged and no parasites.

Box B : Material from W. G. Williams's orchard, Henderson (where bulk of parasites liberated). Placed in emergence-box 30/10/28. First midges appeared 15/11/28; ceased emergence* 24/11/28. First parasite emerged 8/12/28, and a second parasite 10/12/28. In all 200 midges emerged and 2 parasites. Parasitism, 1 per cent.

Box B (i) : Midge-infested material from W. G. Williams's orchard. Placed in box 8/11/28. First midges appeared 26/11/28; ceased emergence 10/12/28. One parasite appeared 3/1/29. Totals, 150 midges and 1 parasite. Parasitism, 0.6 per cent.

Box B (ii) : Midge-infested material from W. G. Williams's orchard. Placed in box 22/11/28. First midges appeared 3/12/28; ceased emergence 18/12/28. First parasites observed 24/12/28, and continued to emerge up to 7/1/29. A few midges continued to emerge up to 10/1/29. Total, 800 midges and 45 parasites. Parasitism, 5.6 per cent.

Box B (iii) : Material from W. G. Williams's orchard. Placed 28/11/28. Midges emerged 10/12/28; ceased emergence 24/12/28. Parasites appeared 4/1/29; ceased emergence 9/1/29. Total, 650 midges and 24 parasites. Parasitism, 3.69 per cent.

Box C : Material from A. L. Aicken, Avondale, Auckland. Placed 27/11/28. First midges emerged 12/12/28; ceased emergence 5/1/29. Total, 290 midges; no parasites.

Box D : Material from H. Dobbie, Epsom, Auckland. Placed 27/11/28. Midges emerged 10/12/28; ceased emergence 3/1/29. Total, 50 midges; no parasites.

Box D (i) : Material from H. Dobbie, Epsom. Placed 1/2/29. Midges emerged 12/2/29; ceased emergence 17/2/29. Parasites emerged 11/3/29. Total, 100 midges and 2 parasites. Parasitism, 2 per cent.

Box E : Material from W. G. Morrison, Birkdale, Auckland. Placed 25/11/28. Midges emerged 13/12/28; ceased emergence 7/1/29. Total, 12 midges; no parasites.

Box F : Material from H. S. Izard, South Road, Auckland. Placed 28/11/28. Midges emerged 13/12/28; ceased emergence 5/1/29. Total, 450 midges; no parasites.

Box G : Material from Hopkins Bros., Auckland. Placed 28/11/28. Midges emerged 12/12/28; ceased emergence 3/1/29. No parasites.

Box H : Material from G. Battersby, Albany, Auckland. Placed 29/11/28. Midges emerged 14/2/28. No parasites.

Box I : Material from W. L. Heather, Whangarei. Placed 29/11/28. Midges emerged 13/12/28; ceased emergence 3/1/29. No parasites.

Box J : Material from A. Bush, South Road, Henderson. Midges emerged 13/12/28; ceased emergence 4/1/29. Total, 300 midges and 1 parasite. Parasitism, 0.33 per cent.

Box K : Material from W. Shaw, Warkworth. Placed 3/12/28. Midges emerged 20/12/28. No parasites.

Box L : Material from Miss Birtles, Huarau. Placed 11/12/28. Midges emerged between 24/12/28 and 3/1/29. Total, 400 midges; no parasites.

Box M : Material from J. O. Triggs, Auckland. Placed 21/12/28. Midges emerged between 24/12/28 and 3/1/29. Total, 10 midges; no parasites.

Box M (i) : Material from J. O. Triggs, Auckland. Placed 14/2/29. Midges emerged 25/2/29; parasites emerged 15/3/29. Total, 20 midges and 6 parasites. Parasitism, 30 per cent.

Box N : Material from L. Padget, Auckland. Placed 4/12/28. Midges emerged 20/12/28; ceased emergence 7/1/29. No parasites.

* "Ceased emergence" means that the main batch of midges had emerged at the time stated; after this date only a scattered few midges appeared on odd occasions.

Box O: Material from W. and H. Hoey, Whangarei. Placed 19/12/28. Midges emerged between 24/12/28 and 3/1/29. No parasites.

Box P: Material from E. M. Bell, Auckland. Placed 1/2/29. Midges emerged 23/2/29. Total, 14 midges; no parasites.

Box Q: Material from C. C. Smithson, Tinopai. Placed 12/2/29. Sixteen midges emerged and no parasites.

These results are in keeping with the writer's field observations. A fair indication of the state of Mr. Williams's orchard is given by the accompanying photograph.



PEAR-TREE IN MR. W. G. WILLIAMS'S ORCHARD, HENDERSON, SHOWING TYPICAL CURLED CONDITION OF LEAVES DUE TO MIDGE-ATTACK.

Early in the season it became apparent that the parasite was not exercising the degree of control for which one hoped. But although the foregoing results present the parasite in a most unfavourable light, it is felt that definite conclusions are still to be avoided until a further series of tests has been carried out next season.

In Mr. Williams's orchard, where the main liberation of parasites took place, one hoped to find evidence of control, but such was not the case. Mr. Williams, who has been most willing to assist throughout, agreed to forward supplies of infested material from week to week.

Unfortunately, he was unable to keep up supplies for very long, owing to the fact that his trees were so severely affected by midge in the earlier part of the season that practically no growth was made afterwards.

To sum up, one can only say that for the past season (1928-29) the midge was not controlled by *Misocyclops marchali*. The exact reasons for this failure are difficult to define at the present juncture, though attention must be drawn to the fact that the times of emergence of the parasite and its host do not coincide. It has been noted that in all cases the main brood of midge had practically ceased emerging about a week, and sometimes longer, before the first parasite appeared. This, it is believed, is a constant feature, and it had also been noted by Mr. Cottier during his last season's work.

INTRODUCTION OF OTHER PARASITES PROPOSED.

In view of the fact that *M. marchali* has not exercised the control hoped for, it is intended to introduce other parasites that may be likely to effect a more satisfactory control. As a basis for further introductions, Dr. Myers's original investigation is valuable. His special mention of *Pilophorus perplexus* should receive primary consideration, for he states that "there can be no doubt that, during July and August at least, *Pilophorus* caused greater mortality among the midge larvæ than all other factors combined." Apart from a study of the life-history of this insect, one would like to know particularly how specialized in feeding-habits *P. perplexus* is. Myers points out in this connection that "many groups of *Miridæ* are much more thoroughly carnivorous than is generally supposed." It is also felt that the introduction of *Torymus abbreviatus* should be undertaken, and it is hoped to effect this for next season.

Dr. G. A. K. Marshall, of the Imperial Bureau of Entomology, has accordingly been communicated with, requesting an estimate of a study of the food habits of *P. perplexus*, with a view to its introduction, and also the possibility of our securing supplies of *T. abbreviatus*.

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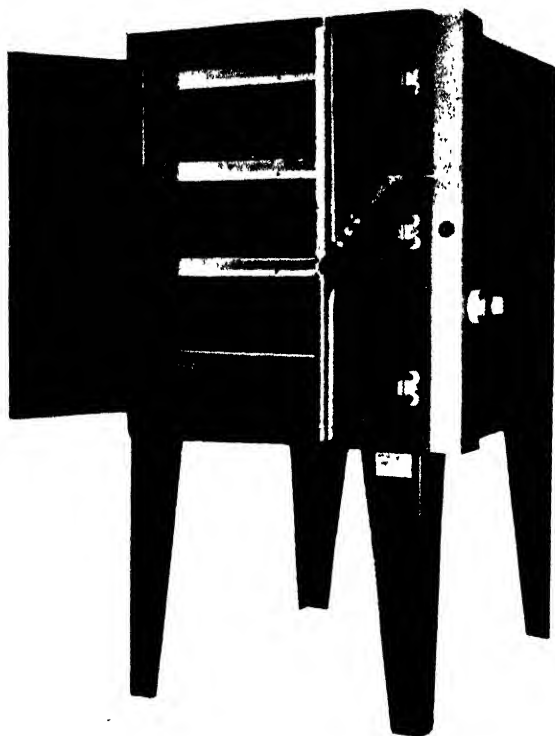
Phormium Research.—Work on plant selection and hybridization is proceeding under Dr. Yeates at Massey College. A fibre-strength-testing machine is available for making tests of the fibre produced from selected and hybridized phormium.

TREATMENT OF HONEYCOMB CAPPINGS.

AN ELECTRIC OVEN MELTER.

E. A. EARP, Senior Apiary Instructor, Horticulture Division.

THERE are a number of melters on the market which facilitate the messy and unpleasant job of dealing with cappings in the apiary. These contrivances are mostly heated by steam, and can be operated when uncapping the combs; thus much labour is saved and the wax and honey segregated. However, with the great advance made in the supply of electric power to rural districts many beekeepers can now



THE ELECTRIC OVEN MELTER.

dispose of their cappings by this agency, either with an electrically heated box or by means of a special oven. Both types of heaters have proved to be a great boon where adopted.

The electric oven here illustrated was made recently to the order of Mr. W. B. Bray, a Banks Peninsula apiarist, by a Christchurch firm. The apparatus is not patented. The oven is large enough to deal with the cappings from about 1 ton of honey in one charge, and with the aid of a clock to cut out the power in the night a second lot could be done while one slept.

The wax is obtained in one solid cake, which only needs washing and a light scraping to be ready for market. The cappings are drained for a day before being put in the oven on trays which slide in. According to the amount of draining, there will be from 60 lb. to 100 lb. of honey obtained in the melter. This honey is equal in grade to the bulk, as it is not injured by the heat it undergoes or by coming into contact with hot slumgum. It is this slumgum which, coming into contact with the honey, stains or darkens its colour and impairs its flavour. The honey runs away first, then the wax, and the slumgum is left on cloths on the screens in the trays.

The increased value of the honey saved, or the saving through there being no loss of value on it, amounts to at least 10s. to 15s. every time the melter is used with a full charge. The power used costs 1s. to 1s. 6d., according to local rates, so the direct saving is considerable. Indirectly the advantages are considerable. The cappings can be dealt with daily at a considerable saving in time, the melter needing no attention once the power is turned on. There is no danger of fire as with boilers and lamps. The wax is ready for market, and there is no risk of damaging the honey as is the case with some melters in use.

The electric oven melter seems, indeed, to have come to revolutionize the cappings problem in commercial apiaries. In operating it the main thing to learn is how long to run the power for the quantity of cappings. The best way is to load it, say, nearly full, and run it a few hours before opening it for examination. It should be run till nearly all the wax has left the slumgum, but not so long as to darken the film of honey that remains on the trays under the screens. After the power has been turned off the oven should be left closed for thirty minutes to an hour to allow more wax to drain out, then opened up to remove the cloths from the screens before they set too hard. The cloths should be soaked in hot water, rinsed, and put away till sufficient accumulate, when they can be boiled up, pressed, washed, and dried for use again. Ordinary cheese-binding should be used for the cloths on the screens.

Commercial beekeepers who have tried the electric method consider that it is away ahead of all others. The chief advantages of the electric oven melter may be summarized as follows: (1) It distributes the heat evenly over the surface of the cappings. (2) It heats all three trays evenly by increasing the heat successively of each lower shelf. (3) The oven can be used for other purposes, such as liquifying 60 lb. tins of honey by the removal of some of the trays and the adjusting of the others on the level; any or all of the trays can be adjusted to a level position. (4) It is constructed to get maximum results from the power used, the oven being insulated with silicate cotton to conserve the heat generated. (5) It is economical in space.

Dairy Research.—Investigations at the Dairy Research Institute, Palmerston North, are being concentrated on the problem of open texture in cheese. Investigations of losses in vitamins occurring during manufacturing processes in dairy factories have been commenced.

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1928.

N. R. FOY, Seed Analyst, Fields Division, Palmerston North.

DURING the calendar year 1928 a total of 10,149 samples were received for testing at the Agriculture Department's Seed-testing Station, this representing a decrease of 619 on the number received for the preceding year. The aggregate was made up as shown in Table 1. The smaller number of rye-grass and clover samples received accounts for almost the whole of the total decrease.

The number of samples received during each month is shown in Table 2, and Table 3 gives the actual tests made and the number of samples submitted for purity or germination or both. Table 4 shows the number of samples received from the different land districts and centres therein. Table 5 gives the number of samples of the various species received for test, and the number of tests made for each species.

GRASSES.

The average purity and germination for the main grasses are given in Table 6, together with the percentage of samples germinating in groups of tens. With certain exceptions, the purity and germination averages compare favourably with those of previous years.

Rye-grasses.—Little improvement was shown in the general average germination for perennial rye-grass. In 1924 and 1925 averages of 86 and 85 per cent. were recorded, with over 40 per cent. of the samples germinating in the 90's. The average fell in 1926 to 77 per cent., with 20 per cent. in the 90's; and in 1927 to 75 per cent., with 9 per cent. of the samples in the 90's. In 1928 a slight improvement was shown in Southern and Sandon seed, but this was offset by the depression in the Hawke's Bay and Canterbury samples. Hawke's Bay is usually a high-germinating seed, but in 1928 nearly half of the samples received germinated under 70 per cent. For both Italian and Western Wollths rye-grasses the germination was shown to be slightly lower than in previous years. In general the purity of all the rye-grass samples was of a high standard. Awned Italian occurred in quantities ranging from 0.5 up to 25 per cent. in samples labelled "rye-grass"; 84 per cent. of the Southern samples and 86 per cent. of the Canterbury samples, 75 per cent. of the Sandon samples, and 45 per cent. of the Hawke's Bay samples contained awned seed of Italian rye-grass. Were it possible to accurately and quickly distinguish between perennial and "de-awned" Italian, these percentages would no doubt be greater. Ergot sclerotia occurred in 54 per cent. of the perennial seed examined, ranging from traces up to 25 per cent. Less than 1 per cent. of the Italian and Western Wollths samples contained ergot.

Cocksfoot.—The average germination of 68 per cent. recorded in 1928 is about the general standard for cocksfoot, Danish being the usual 8 or 10 per cent. higher. The average percentage of impurities (5 per cent.) is higher than for five years past, the high rye-grass content of

Table 1.—Origin of Samples received, 1927 and 1928.

Senders, &c.	Number of Samples.		Increase or Decrease in 1928.
	1928.	1927.	
Seed-merchants	8,509	8,959	450 decrease.
Farmers and seed-growers	206	233	27 decrease.
Government Departments	365	351	14 decrease.
Laboratory tests	890	1,078	188 decrease.
Retests	115	147	32 decrease.
Totals	10,149	10,768	..

Table 2.—Number of Samples received in each Month, 1928 and 1927.

Month.	Number.		Month.	Number.	
	1928.	1927.		1928.	1927.
January	666	490	July	881	892
February	871	682	August	925	1,258
March	1,086	1,038	September	727	1,412
April	872	776	October	995	1,007
May	950	1,000	November	870	982
June	984	753	December	322	478

Table 3.—Classification and Numbers of Samples and Tests, 1928 and 1927.

Classification.	Number.	
	1928.	1927.
Samples for germination only	7,555	7,641
Samples for germination and purity	2,505	2,868
Samples for purity only	89	259
Purity tests made	2,594	3,127
Germination tests made	10,060	10,509
Totals	12,654	13,636

Table 4.—Number of Samples from the different Land Districts and Centres therein, 1928 and 1927.

Land District, &c.	1928.	1927.	Land District, &c.	1928.	1927.
Southland (total) ..	2,950	3,377	Auckland (total) ..	1,191	1,066
Gore	1,417	1,493	City	974	900
Invercargill	1,465	1,774	Other	217	166
Other	168	110	Otago (total)	732	602
Wellington (total) ..	2,221	2,323	Dunedin	698	549
City	1,055	1,301	Other	34	33
Palmerston North and Feilding	779	672	Marlborough	174	228
Other	387	350	Hawke's Bay	238	213
Canterbury (total) ..	1,189	1,880	Taranaki	328	129
Christchurch	667	1,073	Gisborne	23	47
Other	522	607	North Auckland .. ..	..	24
			Nelson	13	1
			Westland .. ..	..	..

Akaroa seed (average impurity 6 per cent.) being mainly responsible for the increase. Rye-grass occurred in 98 per cent. of the samples of Akaroa seed examined, ranging from 0.1 up to 8 per cent. *Poa pratensis* occurred in 68 per cent. of the Akaroa samples examined. The cocksfoot sample in general was entirely free from seeds of noxious weeds, as was also Akaroa seed from the indicator impurities of Danish cocksfoot. In previous years a number of samples marked "Akaroa" have contained seeds of ox-eye daisy, field foxtail, chamomile, and mayweed, the combined presence of which is a positive indication of imported seed. No doubt the legislation requiring the staining of all imported cocksfoot-seed has effectively prevented the blending of Danish and Dominion lines.

Crested dogstail.—The quality of the 1928 crop was excellent, 85 per cent. of the samples received germinating in the 90's. The seeds of

Table 5 ---Number of Samples of various Species tested, 1928 and 1927, and Number of Tests made thereon, 1928

Species.	1928.		1927.	
	Germination Tests	Purity Tests	Samples.	Samples.
Perennial rye-grass (<i>Lolium perenne</i>) ..	2,285	485	2,292	2,748
Italian rye-grass (<i>Lolium multiflorum</i>) ..	406	81	406	450
Western Wolth's rye-grass (<i>Lolium westwoldicum</i>) ..	186	29	186	160
Cocksfoot (<i>Dactylis glomerata</i>) ..	430	110	433	501
Crested dogstail (<i>Cynosurus cristatus</i>) ..	941	520	954	1,187
Chewings fescue (<i>Festuca rubra</i> var. <i>tallax</i>) ..	661	439	678	697
Brown-top (<i>Agrostis tenuis</i>) ..	355	239	357	217
Danthonia pilosa ..	68	33	60	93
Danthonia semi-annularis ..	3	1	3	3
Timothy (<i>Phleum pratense</i>) ..	121	39	123	86
Fog (<i>Holcus lanatus</i>) ..	30	17	31	30
Meadow fescue (<i>Festuca pratensis</i>) ..	25	0	26	33
Meadow foxtail (<i>Alopecurus</i>) ..	37	12	37	21
Paspalum (<i>Paspalum dilatatum</i>) ..	71	13	71	83
Poa pratensis ..	52	20	52	36
Poa trivialis ..	12	6	12	9
Prairie-grass (<i>Bromus unioloides</i>) ..	20	..	20	10
Fiorin (<i>Agrostis stolonifera</i>) ..	6	4	7	7
Red-top (<i>Agrostis palustris</i>) ..	7	3	7	11
Yarrow (<i>Achillea millefolium</i>) ..	47	41	48	10
Other grasses ..	14	1	15	15
Total grasses ..	5,777	2,099	5,827	6,506
White clover (<i>Trifolium repens</i>) ..	411	200	413	444
Cow-grass and red clover (<i>Trifolium pratense</i>) ..	298	97	300	495
Alsike (<i>Trifolium hybridum</i>) ..	71	30	73	54
Alsike and white clover ..	16	5	16	24
Subterranean clover (<i>Trifolium subterraneum</i>) ..	31	8	35	30
Strawberry clover (<i>Trifolium fragiferum</i>) ..	4	..	4	4
Crimson clover (<i>Trifolium incarnatum</i>) ..	44	3	44	24
Suckling clover (<i>Trifolium dubium</i>) ..	34	15	34	30
Lucerne (<i>Medicago sativa</i>) ..	104	22	105	85
English trefoil (<i>Medicago lupulina</i>) ..	30	6	30	34
Lotus major ..	79	45	82	58
Lotus hispidus ..	20	6	20	14
Other clovers, &c. ..	8	..	8	2
Total clovers ..	1,153	437	1,164	1,298

Table 5—continued.

Species.	1928.			1927.
	Germination Tests.	Purity Tests.	Samples.	Samples.
Swede (<i>Brassica campestris</i>)	334	71	334	292
Turnip (<i>Brassica rapa</i>)	412	94	412	433
Rape (<i>Brassica napus</i>)	91	17	91	153
Kale (<i>Brassica acephala</i>)	104	5	104	115
Mustard (<i>Brassica arvensis</i>)	24	3	24	19
Mangel (<i>Beta vulgaris</i>)	235	50	235	201
Carrots (<i>Daucus carota</i>)	101	8	101	149
Total roots	1,301	248	1,301	1,342
Oats (<i>Avena sativa</i>)	28	..	28	29
Wheat (<i>Triticum vulgare</i>)	16	..	16	3
Barley (<i>Hordeum vulgare</i>)	15	..	15	74
Rye-corn (<i>Secale cereale</i>)	6	..	6	5
Tares and vetches (<i>Vicia</i> spp.)	4	..	4	6
Peas (<i>Pisum sativum</i>)	107	..	197	144
Japanese millet (<i>Echinochloa frumentacea</i>)	23	4	23	14
Other forages	10	..	10	6
Vegetables (other than peas)	386	..	386	280
Flower-seeds	77	..	77	..
Forest-tree seeds	117	..	117	121
Seed mixtures	42	33	50	34
Grand totals. . . .	9,158	2,821	9,221	9,862

Californian thistle occurred in 33 per cent. of all samples; in 34 per cent. of Southern and 37 per cent. of Sandon samples; the rate of occurrence was from two up to 250 seeds per ounce, and the average rate of occurrence twelve seeds per ounce. In general dogstail samples showed good colour, which may be taken as evidence of a fairly complete maturity.

Chewings fescue.—Nearly 70 per cent. of the samples received germinated in the 90's, with a general average of 82 per cent., which is slightly lower than that of the previous year. Colour and degree of maturity appeared to be good. Purity generally was excellent, but 92 per cent of the samples contained catsear (*Hypochaeris radicata*), which was by far the most constantly occurring impurity.

Brown-top.—The 1928 season's brown-top was of excellent quality, both as regards purity and germination. The average pure-seed content of 91 per cent. for all samples is a considerable improvement over the 67 per cent. in 1926 and 84 per cent. in 1927. Southern seed gave the highest average purity of 96 per cent., with Canterbury 94 per cent. and Waipu 72 per cent. pure seed. All brown-top samples are now tested on the Continental system, so that senders of samples are now able to make accurate estimations as to quality and value on receipt of report. The "pure germinating seed" percentage given is the only single percentage upon which value can be estimated, or upon which two samples may be compared value for value. The most constantly occurring weed impurities were toad-rush (*Juncus bufonius*)—in 90 per

cent. of the samples ; and mouse-eared chickweed (*Cerastium vulgatum*)—in 59 per cent. of the samples. About 15 per cent. of the samples showed seed infected with *Tilletia decipiens*.

Other Grasses.—The seed of timothy, *Poa pratensis*, *Danthonia* spp., and *paspalum* was of average quality, although 60 per cent. of the samples of the last-named germinated over 50 per cent.

The average germination percentages of the grass-seeds not mentioned in Table 6 were as follows :—

<i>Danthonia semi-annularis</i> ..	50	<i>Ratstail</i> ..	80
<i>Fog</i> ..	91	<i>Prairie-grass</i> ..	84
<i>Poa trivialis</i> ..	50	<i>Fiorin</i> ..	73
<i>Yarrow</i> ..	58	<i>Red-top</i> ..	82
<i>Sheep's fescue</i> ..	45	<i>Indian doob</i> ..	86
<i>Poa nemoralis</i> ..	35		

CLOVERS AND RELATED SPECIES.

The average germination and purity of the main clovers and related species is shown in Table 8. The general averages vary but little from those of previous years.

White clover.—Suckling clover occurred in 90 per cent. of the samples of white clover at the rate of 1 up to 40 per cent. Rib-grass, sorrel, catchfly, and scarlet pimpernel occurred in 75, 88, 32, and 57 per cent. of the samples respectively. Dodder occurred in 2 per cent., and in small quantities only. Table 9 shows the rate of occurrence of the main impurities for all samples, New Zealand white, New Zealand wild white, and imported white clovers respectively. With the exception of

Table 6.—Average Germination and Percentage of Extraneous Seeds for the Main Grasses, 1928.

The figures in parentheses in second column are 1927 averages.

Species.	Germination Percentage.		Percentage of Samples germinating in Groups—							Average Percentage of Impurities.	
	Average.	Maximum.	Minimum	0-49	50-59	60-69	70-79	80-89	90-100.	Commercial Seeds.	Weed-seeds.
Perennial rye-grass	75 (75)	99	5	7	6	15	28	33	11	1.3	0.6
Italian rye-grass ..	78 (84)	98	17	1	4	15	26	34	20	0.5	0.7
Western Wolths ..	79 (82)	100	30	4	2	12	28	30	18	0.2	0.3
Cocksfoot ..	68 (70)	94	2	5	16	30	30	14	5	4.1	0.9
Crested dogstail ..	90 (91)	100	9	1	1	1	2	10	85	1.2	0.2
Chewings fescue ..	82 (86)	100	0	5	2	3	7	16	67	0.3	0.1
Brown-top ..	87 (85)	100	12	3	4	4	6	15	68	0.1	0.6
Timothy ..	81 (88)	100	28	13	8	5	3	7	64	0.2	0.1
Meadow-fescue ..	78 (74)	98	28	20	..	12	..	8	60	0.4	1.8
<i>Poa pratensis</i> ..	64 (57)	79	20	6	27	42	21	4	0	0.5	0.1
				0-19.	20-29.	30-39.	40-49.	50-59.	60-100.		
<i>Danthonia</i> spp. ..	49 (52)	89	0	3	4	12	22	24	35	11.4	9.2
Meadow-foxtail ..	31 (18)	63	4	22	16	39	15	5	3	12.7	27.2
<i>Paspalum</i> ..	47 (41)	69	13	4	11	11	27	21	26	0.0	0.1

Table 7.—Average Germination and Purity of Perennial Rye-grass, Crested Dogtail, Cocksfoot, and Chewings Fescue, grouped according to Place of Origin, 1927 and 1928.

Origin.	Average Per- centage of Im- purities.	Percentage of Samples germinating in Groups—								Average Germina- tion.		Number of Samples.	
		Under 70.		70-79.		80-89.		90-100.					
		1927	1928.	1927.	1928.	1927.	1928.	1927.	1928.	1927.	1928	1927.	1928.
<i>Perennial Rye-grass.</i>													
Dominion	1.9	26	28	33	28	32	33	9	11	75	76	2,713	2,285
Southern ..	1.8	29	23	36	29	32	38	3	10	74	76	1,737	1,497
Canterbury	1.0	18	30	25	28	35	29	22	13	80	74	441	336
Sandon ..	1.6	26	20	31	26	33	23	10	21	74	76	154	117
Hawke's Bay	..	18	49	7	23	38	15	37	13	83	68	100	101
<i>Cocksfoot.</i>													
Dominion	5.0	44	51	33	30	20	14	3	5	70	68	492	430
Danish ..	1.6	16	25	38	44	44	31	2	0	76	74	124	96
Akaroa ..	6.1	73	74	23	19	4	7	0	0	63	64	127	116
Plains ..	3.8	41	31	31	31	20	27	11	11	71	75	54	45
<i>Crested Dogtail.</i>													
Dominion	1.4	4	3	4	2	12	10	80	85	91	90	1,163	941
Southern ..	1.3	2	1	4	2	12	9	82	88	92	94	987	789
Sandon ..	0.6	3	2	1	8	6	19	90	71	94	90	89	85
<i>Chewings Fescue.</i>													
Southern ..	0.4	5	6	9	4	16	7	70	16	86	82	670	661

Table 8.—Average Germination and Purity of the Main Clovers and Related Species, 1928.

The figures in parentheses in second column are 1927 averages.

Species.	Percentage of Germination.			Percentage of Samples germinating between				Seed Impurities.				Average Percentage of Hard Seeds.
	Average.	Maximum.	Minimum.	0-69.	70-79.	80-89.	90-100	Number of Species		Average Percentage.		
								Com- mercial Seeds.	Weed- seeds.	Com- mercial Seeds.	Weed- seeds.	
White clover ..	84 (86)	99	5	13	15	33	39	14	54	3.7	0.7	11.0
Cow-grass ..	86 (87)	100	7	7	7	20	66	19	41	0.4	0.6	5.6
Alsike ..	88 (82)	99	74	1	9	41	49	11	22	1.6	0.2	5.4
Subterranean clover	86 (88)	99	72	9	26	18	47	2	4	0.1	0.5	11.7
Strawberry clover	72 (65)	81	66	0	25	51	24	..	..	..	..	25.0
Crimson clover ..	55 (77)	100	9	51	14	14	21	5	8	0.2	0.2	0.1
Suckling clover ..	66 (60)	94	14	48	32	8	12	12	30	18.4	4.4	21.0
Lucerne ..	80 (75)	99	26	22	23	25	30	10	21	0.7	0.1	14.3
English trefoil ..	68 (64)	94	8	36	20	27	17	4	9	0.1	0.1	2.6
Lotus major ..	76 (70)	96	20	30	25	27	18	19	43	6.2	0.6	13.4
Lotus hispidus ..	53 (53)	86	32	90	5	5	0	13	17	11.0	6.3	37.8

Trifolium arvense, note the lesser occurrence of the annual species of wild white, also the non-occurrence of *Silene gallica* and *Trifolium arvense* in imported white, and the non-occurrence of *Silene noctiflora* in New Zealand seed. Of the total samples examined 25 per cent. contained cluster clover, which impurity was present in most of the seed grown in Hawke's Bay, several samples containing over 30 per cent. A number of samples received labelled "clover-seed" consisted of suckling, haresfoot trefoil, clustered clover, and hop trefoil, in varying percentages, with a slight trace of white clover.

Other Clovers.—The germination percentages of other clover-seeds, not included in Table 9, were as follows:—

						Hard Seeds.
Alsike and white (mixed)	..	..	..	..	73	10
Lotus corniculatus	..	..	..	..	70	5
Sweet clover	..	..	..	..	45	20

Table 9.—Occurrence of Main Impurities in White Clovers, 1928.

The figures signify the number of samples in each 100 examined which contained the individual impurity.

Impurity.			All Samples.	N.Z. White	N.Z. Wild White.	Imported White.
<i>Commercial Seeds</i>						
<i>Trifolium dubium</i>	..	..	90	93	100	44
<i>Trifolium hybridum</i>	..	..	77	89	83	80
<i>Trifolium pratense</i>	..	..	69	77	42	65
<i>Phleum pratense</i>	..	..	23	20	8	56
<i>Holcus lanatus</i>	..	..	31	32	20	10
<i>Medicago lupulina</i>	..	..	20	15	16	90
<i>Lolium</i> spp. (kernels)	..	..	32	41	29	21
<i>Lotus major</i>	..	..	3	1	..	..
<i>Phalaris</i> spp.	..	..	1	2	..	..
<i>Weed-seeds</i>						
<i>Rumex acetosella</i>	..	..	88	84	83	89
<i>Plantago lanceolata</i>	..	..	76	82	42	78
<i>Chenopodium album</i>	..	..	44	49	42	45
<i>Anagallis arvensis</i>	..	..	57	72	38	5
<i>Silene gallica</i>	..	..	38	36	29	..
<i>Stellaria media</i>	..	..	21	18	..	70
<i>Prunella vulgaris</i>	..	..	17	12	..	45
<i>Cerastium vulgatum</i>	..	..	17	17	8	10
<i>Sisymbrium officinale</i>	..	..	8	4	..	10
<i>Spergula arvensis</i>	..	..	17	11	8	24
<i>Trifolium arvense</i>	..	..	22	23	38	..
<i>Plantago major</i>	..	..	6	1	4	..
<i>Polygonum aviculare</i>	..	..	2	1	..	..
<i>Cuscuta trifolii</i>	..	..	2	1	..	..
<i>Anthoxanthum odoratum</i>	..	..	7	5	4	..
<i>Silene noctiflora</i>	..	..	4	..	..	80
<i>Rumex crispus</i>	..	..	7	2	4	..
<i>Sherardia arvensis</i>	..	..	8	8	4	..
<i>Crepis capillaris</i>	..	..	4	1	..	..
<i>Geranium pusillum</i>	..	..	2	..	..	15
<i>Myosotis arvensis</i>	..	..	2	..	..	25
<i>Trifolium glomeratum</i>	..	..	8	2	..	..

ROOTS AND CRUCIFEROUS FORAGES.

The average germination figures for this group are shown in the following table:—

Table 10.—Average Germination Percentages of Roots and Cruciferous Forages, 1928 and 1927.

	Germination.				Percentage of Samples germinating between									
	Average.		Max.	Min.	1-59.		60-69.		70-79.		80-89.		90-100.	
	1928.	1927.	1928.	1928.	1928	1927.	1928	1927.	1928.	1927.	1928.	1927.	1928.	1927.
Swede ..	84	81	100	2	6	4	4	10	12	21	25	29	53	36
Turnip ..	88	83	100	6	4	4	5	2	10	6	15	19	34	68
Rape ..	92	89	100	11	1	2	2	4	3	5	18	24	76	65
Kales ..	81	80	99	10	10	6	12	10	12	16	30	31	36	37
Mangel ..	76	83	92	40	9	3	16	18	32	28	34	32	9	9
Carrot ..	61	60	90	30	44	44	23	28	13	15	11	10	9	2

VEGETABLE-SEEDS.

The average germination percentages of vegetable-seeds tested were as follows: Asparagus, 24; beet, 72; broccoli, 74; brussels sprouts, 97; beans, 85; cabbage, 83; cress, 90; cauliflower, 73; celery, 52; cucumber, 85; lettuce, 96; leek, 89; melon, 84; marrow, 83; onion, 62; parsley, 70; pumpkin, 69; parsnip, 75; radish, 75; rhubarb, 67; spinach, 52; squash, 88; tomato, 86.

CEREALS, ETC.

Following were the average germination percentages of this group: Oats, 89; wheat, 98; barley, 93; rye-corn, 60; maize, 92; tares, 95; millet, 69; lupins, 95.

FLOWER-SEEDS.

Flower-seeds tested gave the following average germination percentages: Cornflower, 72; pansy, 46; Aquilgia, 15; larkspur, 47; coreopsis, 22; Phlox Drummondii, 67; verbenia, 25; candytuft, 66; Myosotis, 30; Campanula, 25; Aster, 42; Calleopsis, 50; Nemesia, 66; Linum, 36; Mathiola, 60; Salvia, 34; Physalis, 36; Viola, 26; Antirrhinum, 46; Linaria, 50; Anemone, 66; Eschscholtzia, 68; Schizanthus, 84; Nemophila, 16; Clarkia, 44; Arctotis, 34; Penstemon, 45; Delphinium, 66.

FOREST-TREE SEEDS.

A number of samples of forest-tree seeds were tested during the year, and the average germination percentages for twenty-three species can be supplied to persons interested.

EXPORT AND IMPORT OF SEEDS.

Table 11 shows the quantities of seed exports and imports for the years 1925, 1926, 1927, and 1928, together with the values for the latter year. Points of special interest are: Decrease in export of cow-grass

Table 11.—*Export and Import of Grass and Clover Seeds, 1925 to 1928.*

Species.	1925.	1926.	1927.	1928.	
				Quantity.	Value.
<i>Exports.</i>					
	Cwt.	Cwt.	Cwt.	Cwt.	£
Cow-grass	4,253	4,657	9,628	1,495	8,433
White clover	647	2,115	2,388	835	6,526
Other clovers	985	717	928	350	1,768
Total clovers	5,885	7,489	12,944	2,680	16,727
Brown-top	514	475	301	1,131	10,078
Chewings fescue	7,483	13,923	17,418	17,124	71,247
Crested dogtail	3,985	2,309	5,434	4,844	20,769
Rye-grass	23,241	29,546	50,162	20,581	24,117
Cocksfoot	*	*	*	496	2,755
Other grasses	5,071	4,685	4,489	3,382	15,763
Total grasses	40,298	50,938	77,804	47,558	144,729
Total grasses and clovers	46,183	58,427	90,748	50,238	..
Total value	£155,029	£203,798	£257,136	£161,456	£161,456
<i>Imports.</i>					
Red clover	*	*	*	762	3,575
White clover	*	*	*	1,748	11,299
Alsike	*	*	*	2,806	15,385
Other clovers	*	*	*	1,497	10,988
Total clovers	6,451	8,283	2,657	6,813	41,257
Cocksfoot	10,091	15,616	5,619	9,145	34,210
Lucerne	1,027	575	527	17	281
Paspalum	1,378	1,717	1,940	3,026	17,598
Rye-grass	40	334	69	20	33
Timothy	4,142	1,980	2,905	4,765	7,563
Poa pratensis	*	*	*	51	339
Other grasses	3,004	3,604	1,741	1,839	10,087
Total grasses	19,682	23,835	12,801	18,863	60,116
Total grasses and clovers	26,133	32,118	15,458	25,676	101,373

* Figures not available.

and white clover for 1928, due to poor crops; increase in export of brown-top; decrease in import of lucerne; increase in import of paspalum.

Certificate of Record and Official Herd-test.—The testing of purebred dairy cows continues to hold up well this year. C.O.R. breeders testing in April numbered 226, some 638 cows having been tested. The corresponding figures for April, 1928, were 176 breeders and 547 cows. The number of breeders participating in the Official Herd-test during the month was 119, and these tested 1,486 cows, as compared with 105 breeders testing 1,332 cows in the same month a year ago

JERSEY C.O.R. BULL NGAHIWI SILENT KNIGHT.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE Jersey bull Ngahiwi Silent Knight bears the distinction of being the first C.O.R. champion butterfat bull whose sire is also a similar champion. Ngahiwi Silent Knight was bred and is owned by Mr. W. J. Freeth, of Pukearuhe, Taranaki, and is a son of Grannie's Knight, a Jersey sire well known throughout New Zealand. Mr. Freeth has been granted certificates for eleven daughters of Ngahiwi Silent Knight, and their performances have certainly been very creditable. All eleven commenced test in the junior two-year-old class, and a classification of their certificates-of-record shows that three produced over 400 lb. butterfat, three over 450 lb., four over 500 lb., and one over 550 lb.



NGAHIWI SILENT KNIGHT.

Grannie's Knight has no less than fifty-six C.O.R. daughters to his credit, which is the largest number sired by any one C.O.R. bull up to the present. More than twenty of his daughters have gained certificates on productions exceeding 500 lb. butterfat, and one of his daughters, Holly Oaks Annie, with 1,056 lb. butterfat, is New Zealand's champion C.O.R. Jersey cow. Grannie's Knight was sired by K.C.B., who is generally admitted to be one of the best Jersey bulls we have had in the Dominion.

The dam of Ngahiwi Silent Knight is Mr. Freeth's Treasure Trove (bred by Mr. John Hale of New Plymouth), who gained a C.O.R. for 571.26 lb. butterfat. Treasure Trove is by Miro Meadow's Boss (sire of five C.O.R. daughters, three of which produced over 500 lb. butterfat) from Treasure's Dot, who has a C.O.R. for 565.05 lb. butterfat. Miro Meadow's Boss is by Admiral of Puketapu (sire of nineteen C.O.R.

daughters) from Waif, who, although not tested, is said to have been a very fine old cow. She was descended from Silky and Marquis. Treasure's Dot is by Soumise Tom, another champion butterfat bull, and a son of Soumise Majesty.

This brief summary is sufficient to show that Ngahiwi Silent Knight's pedigree is an unusually strong one from the point of view of production records. It is an old saying that heredity is the basis of successful breeding practice. Ngahiwi Silent Knight appears to be a concentration of those factors which are most desirable—high production and the ability to transmit it.

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1928-29.

R. MCGILLIVRAY, Fields Superintendent, Christchurch, and J. G. MCKAY, Farm-manager, Ashburton.

THE principal work at the Ashburton Experimental Farm during the past season was that of wheat selection, and the growing of trial lines in connection with potato certification. Brief notes on these and other operations are recorded below.

WHEAT VARIETIES.

During the 1926-27 season Mr. J. W. Hadfield, Agronomist, made selections from a number of wheat varieties. A head-to-row trial was conducted in the 1927-28 season; from that trial the most promising strains were selected, and the following varieties were put on a yield trial: Velvet Chaff, Hunter's, Dreadnought, Solid-straw Velvet, Major, White-straw Tuscan, Solid-straw Tuscan.

Velvet Chaff, Hunter's, Dreadnought, and Solid-straw Tuscan were autumn-sown, and the remainder were sown in August. The residue of seed from each selection was sown in larger plots adjoining the variety trials. All plots were hand-harvested, and threshed with a small electrically driven peg-tooth thresher, which did excellent work. Bulk lines from the best strains are being dressed for future sowings. All seed used in the various trials was treated by the hot-water method and with Semesan by Mr. J. C. Neill, Field Mycologist. Weather and soil conditions were favourable during the brairding-period, and germination was distinctly high. On both autumn- and spring-sown plots occasional small patches were affected by take-all, while white-head and wheat-scab were in evidence more or less on all Solid-straw Tuscan plots. The presence of take-all was probably due to soil-infection, as, although the block was in potatoes the previous year, three consecutive wheat crops had been taken prior to that. Damage done by the scab was apparently negligible, as some of the worst-affected selections produced grain of good quality, and in some cases superior to grain produced from practically scab-free lines.

A miscellaneous collection of other varieties was grown for identification and selection purposes as follows: Pearl, Red Fife, Marquis,

White-straw Tuscan, Marquis No. 4, Garnet \times Canada. A number of off-types were observed in the last two varieties mentioned, and selections were made to determine whether these were the result of breaking or simply rogues.

A selection of Marquis known as Marquis 10 B was received from Canada and autumn-sown on light land at the rate of 1 bushel per acre. The crop threshed 30 bushels per acre, which may be considered quite satisfactory. In habit of growth this selection was very similar to the original Marquis, and the straw had a slight tendency towards weakness in the later stages of growth. The grain produced, though somewhat smaller than the local Marquis, is larger than the parent seed, but less flinty.

A line of Dreadnought rogued in 1925 was grown on the farm during the season, in continuation of a practice extending over several years, for the purpose of supplying seed to certain farmers in North Otago, where the variety is in favour. As a result of this crop following wheat, take-all developed to a serious extent, and it has therefore been decided to scrap the whole line.

WHEAT SEED-TREATMENT TEST.

A "treatment of seed" trial with wheat to determine the effect of various treatments on germination and yield was conducted on an area used for variety trials in the preceding season. The various treatments and rates of seeding (sown with twenty-two replications) were as follows:—

	Seed sown per Acre.			
Semesan, 2 oz. per bushel	90 lb.
Semesan, 2 oz. per bushel	105 lb.
Bluestone, 1 lb. to 10 gallons water	105 lb.
Copper carbonate, 3 oz. per bushel	105 lb.
Formalin, 1 pint to 60 gallons water	105 lb.
Untreated seed	105 lb.

In all treatments, except bluestone, germination was practically the same. Bluestone showed a considerable lowering of germination on all plots. Indications from plot-yields were not sufficiently conclusive to warrant publication, and further work will be undertaken to determine the relative relation of treatments to yield.

POTATO CERTIFICATION LINES.

An area of 4 acres was under these trials, and approximately 177 lines entered for certification were grown on the farm. In order to more definitely test the cropping-powers of each line a system of plot-replication was adopted. Each lot of one hundred sets was divided into five lots and planted in different localities in the field. The increasing interest taken by farmers in potato certification and their expressed appreciation of the Department's work along the lines of potato-improvement is most encouraging. Various selections of different varieties were also grown on the farm, and short rows of tubers affected with various virus and other diseases were planted on the south side of the field. This section proved of more than ordinary interest, and was a spectacular demonstration of the many troubles to which the potato crop is heir.

FIELD-PEA VARIETY TRIALS.

Sufficient seed to sow two areas of $\frac{1}{2}$ acre each with the Harrison's Glory and Marrow-fat varieties was treated with hot water and Semesan by the Field Mycologist. Sowing was carried out in September at 4 bushels per acre, with $1\frac{1}{2}$ cwt. superphosphate per acre. Germination was rapid and most satisfactory. Collar-rot discoloration appeared on the roots of a number of plants early in December, and spread to the stems during the ripening-period, but the damage was not very great, and even the affected plants podded well, Harrison's Glory yielding 68 bushels per acre.

Over one hundred selections were made from various varieties of peas grown in short rows. Trials will be put in hand with these selections next season.

BULL MOOSE LINSEED.

A number of single-plant selections were made of the Bull Moose variety of linseed, with a view to producing, if possible, a taller-growing strain. This variety is particularly valuable on account of its high yield on certain types of soil and the high percentage of oil that can be extracted. The selections gave excellent promise of success along the lines desired.

ALGERIAN OATS FOR SHEEP-FEED AND HARVESTING.

These were sown in March at the rate of 2 bushels per acre with 1 cwt. super per acre. The purpose of this crop was to provide winter and early spring feed for breeding - ewes. There are differences of opinion regarding the actual feeding-properties of this crop, but there can be no doubt as to its usefulness for wintering failing-mouth ewes and furnishing spring feed for ewes and lambs. If grazed under damp conditions and when the growth is somewhat rank scald is frequently set up, and a large proportion of the ewe flock last season suffered from lameness from this cause. This crop was fed until the end of September and then closed up. It was harvested in January, and gave approximately 2 tons of chaff per acre.

LUCERNE.

The lucerne areas are still a strong feature of the farm. The carrying-capacity of the best fields for grazing was approximately 3.8 sheep per acre during the period 16th September until 14th January. Later grazing data are not yet available. The early summer months were wet and the stock did not do as well as usual. The first draft of lambs were not got away until February. A considerable quantity of lucerne hay has been saved, and will be used for the ewe flock during the winter period.

EDUCATIONAL, ETC.

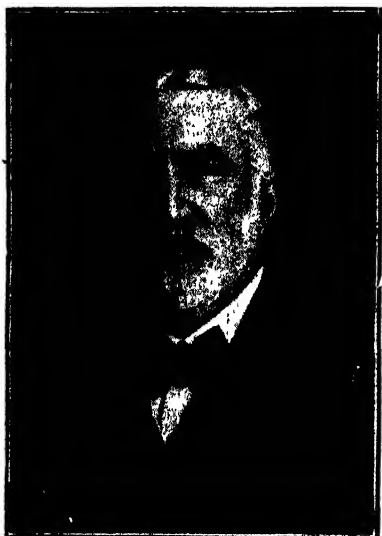
A very successful farmers' field-day was held on 8th January last, when there was a representative attendance of two hundred farmers from various parts of Canterbury. A day was also set aside for the purpose of enabling merchants to see what has been done on the farm in connection with crop-improvement work.

The farm is also serving another useful purpose as a centre from which the Agronomist gives instruction to Instructors in Agriculture who are directly connected with the operations of crop certification.

THE LATE SIR JAMES WILSON.

THE *Journal* places on record its tribute to the memory of Sir James Wilson, who passed away full of years though still partially in harness, on 3rd May. Sir James was brought into specially close contact with the Agriculture Department through the Board of Agriculture, over which body he had presided since its inauguration in 1914. In this capacity his wide experience in public life, practical association with rural interests, and immense fund of agricultural information rendered him a most valuable adviser on many important questions arising

through the years. One of Sir James's strongest interests was that of agricultural education in all its forms—from farm instruction and demonstration to University course—and in this he was intimately associated with the late Edwin Hall. In 1925 he led the Board of Agriculture, together with representatives of the Agriculture and Education Departments and the University Senate, in a comprehensive survey of the question with reference to New Zealand conditions, the inquiry resulting in valuable recommendations to the Government. Another related activity was the chairmanship of the Commission appointed in connection with the Cawthron bequest, from which the Cawthron Institute of Scientific Research was evolved. Forestry as an interest allied to agriculture also claimed his keen support, and he presided over the



New Zealand Forestry League for a number of years. Sir James, who settled in the Lower Rangitikei district in the "seventies," remained an active farmer all his life. It is significant of his broad sympathies with the man on the land that he identified himself with the New Zealand Farmers' Union from its beginnings, and held the position of president of that organization for some twenty years. He had been aptly termed the Grand Old Man of rural New Zealand: the name of James Glenly Wilson will be writ large in our agricultural annals.

Wool Research.—Investigations were recently commenced at Massey and Lincoln Colleges on sectional problems of the sheep and wool industry. At the former institution Dr. Scrivener is pursuing a research into the relation of wool-yolk to environment and feed, and Dr. Dry is investigating problems connected with fleece development.

WHEAT-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1928-29.

A. W. HUDSON, B.Ag., B.Sc., Crops Experimentalist, Fields Division.

AN outline of objectives of the Fields Division's wheat-manuring experiments was given in the *Journal* for May, 1928, in an article recording the results for the 1927-28 season. No alterations were made in the design of previous work, but a considerable extension was effected in the 1928-29 season. This was made possible by a larger staff, and better facilities for threshing the experimental plots. Experiments of the standard types, the treatments of which are shown below, were conducted on sixteen farms throughout Canterbury and North Otago, two experiments being laid down on each farm. Of the thirty-two trials, those on one farm in Canterbury had to be abandoned owing to the paddock having to be reploughed on account of heavy germination of wild oats, and those on three farms in North Otago were ruined by the severe hailstorm experienced there in January. Consequently only twenty-four experiments reached completion.

In Canterbury the trials were ably conducted by Instructors A. Y. Montgomery, R. A. Calder, and E. M. Bates, under Mr. R. McGillivray, Fields Superintendent. The North Otago experiments were efficiently carried out by Instructors A. A. Hume and T. Sellwood, under Mr. R. B. Tennent, Fields Superintendent.

Manurial Treatments.

The treatments used in the standard type of experiment are as follows, the quantity stated being at per-acre rate:—

Experiment type A—

- (1) No manure.
- (2) Superphosphate (44·46 per cent tricalcic phosphate) .. 1 cwt.
- (3) Basic super (41·43 per cent. tricalcic phosphate) .. 1 cwt.
- (4) Ephos phosphate (guaranteed 54 per cent. tricalcic phosphate) 1 cwt
- (5) Nauru phosphate (about 80 per cent tricalcic phosphate) 1 cwt

Experiment type B—

- (1) Superphosphate 1 cwt.
- (2) Super 1 cwt., plus muriate of potash 1 cwt .. 2 cwt.
- (3) Super 1 cwt., plus nitrate of soda 1 cwt.* .. 2 cwt.
- (4) Super 1 cwt., plus muriate of potash 1 cwt., plus nitrate of soda 1 cwt. .. 3 cwt

* The nitrate of soda was top-dressed in September.

One of each of this set of treatments was laid down on each farm under experiment, the trials being immediately alongside each other in the same field. Each treatment was replicated eight to ten times, and each plot divided into two at harvesting. As a result, up to twenty separate plots were harvested in each treatment. Solid-straw Tuscan wheat was sown in nearly all cases, the seed being treated with copper carbonate as a preventive for stinking-smut.

All results have been submitted to statistical examination, and where a difference in yield is indicated as being "significant" every

confidence can be placed in the results. A difference which is not significant must be viewed as though the yields of treatments under discussion were exactly alike.

Results of Type A Experiments.

The whole of the results of the type A experiments are set out in the following table:—

Table I.—Data regarding Type A Experiments in 1928–29 Season.

Farmer and Locality.	Previous Crop (1927–28 crop mentioned first).	Date of Sowing Experiment.	Date of Harvest- ing.	Yields of Treatments in Bushels per Acre.					Increase over No- manure due to Super.
				No Manure.	Super.	Basic Super.	Ephos Phosphate.	Nauru Phosphate.	
(1) Ashworth Bros., Sefton	Grass for several years	17/7/28	2/2/29	35.7	49.5	44.5	37.9	36.9	13.8
(2) C. G. Amyes, Fernside	Ditto ..	8/7/28	6/2/29	40.4	50.8	45.9	43.1	42.2	10.4
(3) D. Mulholland, Dar- field	.. ..	13/7/28	11/2/29	39.0	46.9	45.4	43.5	43.4	7.9
(4) F. W. Carpenter, Preb- bleton	Wheat, peas, following grass	2/7/28	1/2/29	22.4	23.6	23.6	21.5	22.1	1.2
(5) L. Oakley, Rakaia ..	Grass for three years	27/6/28	6/2/29	64.8	66.6	63.1	64.1	63.6	1.8
(6) E. Body, Methven ..	Wheat following grass	22/5/28	11/2/29	52.3	54.3	54.2	53.1	52.7	2.0
(7) A. Amos, Wakanui ..	Ditto ..	3/7/28	7/2/29	48.1	51.0	50.9	49.8	50.0	2.9
(8) J. Bland, Winchmore	Grass for three years	25/6/28	4/2/29	60.0	66.4	63.0	62.1	62.0	6.4
(9) J. W. Topham, Aro- whenua	Potatoes, wheat, grass	14/6/28	4/2/29	51.1	58.1	57.6	53.4	52.8	7.0
(10) P. R. Talbot, Clare- mont	Rape, wheat, green feed, oats, grass	18/7/28	14/2/29	29.6	39.9	36.9	32.1	31.4	10.3
(11) D. Caird, Southburn	Grass for five years	16/7/28	15/2/29	29.2	35.5	34.0	32.8	30.7	6.3
(12) F. Saunders, Stud- holme Junction	Potatoes, oats, peas	5/7/28	12/2/29	32.4	36.2	35.0	33.8	33.7	3.8
Average yields .. ..	.. ..	.. ..	.. ..	42.1	48.2	46.2	43.9	43.5	..
Average increases over no- manure	.. ..	.. ..	.. ..	..	6.1	4.1	1.9	1.4	6.1

Remarks.

(Numbers refer to experiment numbers in table above.)

(1) (2) The yield from super is significantly better than that of any other treatment.

(3) (4) The yield from super is significantly better than that from any other treatment except basic super.

(5) The results of this experiment have not been examined statistically. Mr. Bates reports that the threshing-machine was working unsatisfactorily, and that in his opinion the results are of little value. He states that each of the super and basic super plots had one to one and a half more sheaves than the other treatments. Further, super and basic super plots ripened earlier than the others. These points are highly reliable indications of substantial increases in yield.

(6) The increases of both super and basic super over no-manure are the only significant differences.

(7) The yield from super is significantly better than those from no-manure and Ephos.

(8) The yield from super is significantly better than that from any other treatment.

(9) The yield from super is significantly better than that from any other treatment except basic super.

(10) (11) The yield from super is significantly better than that from any other treatment.

(12) The yield from super is significantly better than that from any other treatment except basic super.

COMMENTS ON TABLE I.

Each yield is the average of twenty plots, each of which was seven coulter rows wide by $1\frac{1}{2}$ chains in length (the length varied a little in different experiments). In the individual experiments only the increase in yield caused by super is shown. In Experiments 1, 2, 8, 10, 11, super shows significant superiority over all other treatments. In Experiments 3, 4, 6, 7, 9, 12, super and basic super are approximately equal in yield, and in the main superior to other treatments. In every case super has given a significant increase over no-manure.

The relative merits of the manures for the season under review can be seen at a glance at the foot of the table, and indicate quite clearly the advantages of super.

Some of these trials are particularly interesting as indications of seasonal variations (and possibly paddock variations) in response to manure. Experiment 4, on the farm of F. W. Carpenter, was conducted on the same field as last year's experiment. Last year super gave an increase of 8.1 bushels over no-manure; this year the increase is only 1.2 bushels.

E. Body's farm (Experiment 6) is less than a mile from J. McNulty's, where last year's trial was conducted in this district. Last season's super caused an increase of 7 bushels, this year on Body's farm the increase is only 2 bushels.

Experiment 9, on J. W. Topham's farm, was conducted on a paddock alongside last season's trial paddock. Last year super gave no increase; this year the increase is 7 bushels.

Profit resulting from Use of Super.—Reckoning wheat as worth 5s. per bushel of increase (threshing and haulage charges, &c, must be deducted from market price) and super at 5s. per hundredweight, it is evident that an increase of 1 bushel is sufficient to meet the cost of the manure. (A small amount should be allowed for cartage and application.) The average increase of all experiments shows a net profit of approximately 25s. per acre, or something like 500 per cent. on the outlay.

Results of Type B Experiments.

The results of all these experiments are shown in Table 2 (next page).

COMMENTS ON TABLE 2.

The superphosphate-treated plot is used as the standard for comparison in each of the experiments, the results of which are discussed below. It is assumed that the super would have given the same increase over no-manure had the latter treatment been included, as it did in the adjoining experiment. This increase is carried forward from Table 1 and shown in the second-last column.

Effect of Potash as Addition to Super.—The column of yields of super plus potash shows that in only three trials has the potash caused a significant increase. Only one of these increases—that in Experiment 6—can be regarded as paying. The cost of 1 cwt. of muriate of potash is approximately 15s., so that a 3-bushel increase at least is required to meet the cost of the potash.

Table 2.—Data regarding Type B Experiments in 1928-29 Season.

(For experiment type A carried out in the same fields respectively, see corresponding number in Table 1.)

Farmer and Locality.	Number of Plots harvested in each Treatment	Date of applying Nitrate of Soda.	Yields of Treatments, and Difference from Super (where significant) in Brackets below Yields.				Increase given by Super in adjoining Experiment A.	Increase of Super and Nitrogen over No-manure.*
			Super	Super plus Potash	Super plus Nitrate of Soda.	Super plus Potash plus Nitrate of Soda.		
(1) Ashworth Bros., Sef-ton	18	11/9/28	48.8	48.2	48.5	45.3 (-3.5)	13.8	13.8
(2) C. G. Amyes, Fernside	20	6/9/28	47.8	47.9	53.8 (+6.0)	47.3	10.4	16.4
(3) D. Mulholland, Dar-field	20	10/9/28	41.7	40.5	47.9 (+6.2)	45.2	7.9	14.1
(4) F. W. Carpenter, Preb-bleton	18	10/8/28	16.8	18.2 (+1.4)	22.3 (+5.5)	23.0 (+6.2)	1.2	6.7
(5) L. Oakley, Rakaia	20	20/9/28	69.5	66.9	69.1	69.5	1.8	1.8
(6) E. Body, Methven	18	19/9/28	54.0	58.6 (+4.6)	64.8 (+10.8)	64.9 (+10.9)	2.0	12.8
(7) A. Amos, Wakanui	19	27/9/28	52.2	51.2	59.9 (+7.7)	58.5 (+6.3)	2.9	10.6
(8) J. Bland, Winchmore	20	28/9/28	60.3	61.0	63.7 (+3.4)	63.1	6.4	9.8
(9) J. W. Topham, Aro-whenua	16	27/9/28	66.9	68.4 (+1.5)	72.4 (+5.5)	72.7 (+5.8)	7.0	12.5
(10) P. R. Talbot, Claremont	16	20/9/28	33.3	33.4	38.8 (+5.5)	38.5 (+5.2)	10.3	15.8
(11) D. Caird, Southburn	10	25/9/28	34.1	35.9	34.3	33.4	6.3	6.3
(12) F. Saunders, Stud-holme Junction	16	29/9/28	34.8	35.1	36.8 (+2.0)	35.9	3.8	5.8
Average increases over no-manure	..	..	..	..	..	..	6.1	10.5

* This represents the superphosphate increase shown in Experiment A added to increase due to nitrogen in Experiment B.

Remarks.

(1) Neither potash nor nitrogen used alone with super have affected the yield. When used conjointly with super the yield has been depressed by 3.5 bushels per acre.

(2) Nitrate of soda has caused an increase of 6.0 bushels per acre over super. Potash used alone with super had no effect, but when combined with super and nitrogen a definite depression to a yield just about equalling super has occurred.

(3) The same remarks apply as for No. 2, although the depression due to potash when used with super plus nitrogen is not so great, being 2.7 bushels. The depression is significant.

(4) The addition of potash to super has caused a small increase of 1.4 bushels. The addition of nitrate of soda has increased the yield over super by 5.5 bushels. The complete manure has not done appreciably better than super plus nitrogen.

(5) See No. 5 remarks under Table 1.

(6) Potash added to super has caused an increase of 4.6 bushels per acre. Super plus nitrogen is better than super by 10.8 bushels, but potash added to super plus nitrogen has failed to increase the yield.

(7) Nitrogen has caused a substantial increase of 7.7 bushels. Super plus potash does not differ significantly from super. Super plus potash plus nitrogen is significantly lower than super plus nitrogen by 1.4 bushels. Hence potash in the complete manure has depressed the yield.

(8) The addition of nitrate of soda has increased the yield above super alone by 3.4 bushels per acre. Potash has had no appreciable effect.

(9) A small increase has resulted from the addition of potash to super. Nitrogen added to super has caused an increase of 5.5 bushels. Potash added to super plus nitrogen has not improved the yield appreciably.

(10) Potash has not affected the yields. Nitrate of soda has caused an increase of 5.5 bushels per acre.

(11) There are no significant differences between treatments.

(12) The only significant increase over super is that caused by the addition of nitrate of soda.

It should be noted that the nitrogen in Experiment 6 caused an increase of 10.8 bushels, and although potash added to super has caused an increase of 4.6 bushels, when potash is used in conjunction with super plus nitrogen no benefit is derived from the potash, the yield from the complete mixture being practically the same as that from super plus nitrogen.

Effect of Top-dressing Superphosphate Plots with Nitrate of Soda.—In the column headed "Super plus Nitrate of Soda" it will be seen that in nine of the trials nitrate of soda caused significant increases, ranging from 2 to 10.8 bushels per acre, with an average for the nine of 5.8 bushels. If the whole twelve are averaged the increase is 4.4 bushels per acre. Nitrogen has been used on F. W. Carpenter's farm for four years in succession, and has caused an increase of between 5 and 6 bushels per acre in each season.

The cost of nitrate of soda at Christchurch during the past season was 18s. per hundredweight, so that just over 3½ bushels of wheat are required to pay for the quantity applied. Other forms of nitrogen will be on the market next season at a much lower cost, and it can be assumed that the price will be such as to be covered by the value of 2½ to 3 bushels of wheat (12s. 6d. to 15s.). Therefore any of the increases shown above which exceed 3 bushels per acre can be regarded as returning more than the cost of the nitrogen.

Using the averages shown at the foot of the two last columns, the following indicate the approximate financial position as a result of using (1) super, and (2) super plus nitrogen.

- (1) Value of 6.1 bushels increase from super at 5s. per bushel = 30s. 6d.
Cost of 1 cwt. super = 5s., net profit = 25s. 6d.
- (2) Value of 10.5 bushels increase from super plus nitrogen = 52s. 6d. Cost of 1 cwt. super = 5s. plus cost of 1 cwt. nitrogenous fertilizer (say), 13s. = 20s., net profit = 34s. 6d.

Effect of using Super, Potash, and Nitrogen.—The combined effect of the three fertilizers is interesting. In Experiments 1, 2, 3, and 7 significant depressions in yield below those given by super plus nitrogen have occurred as a result of using all three fertilizers. In Experiments 4, 6, 9, where potash used with super gave increases, the use of the three substances has in no case given a significant increase over super plus nitrogen. In Experiments 5, 8, 10, 11 there is no significant evidence of the benefit of using the complete mixture.

Experiments on Use of different Forms of Nitrogen.

The promise shown by nitrate of soda as a spring top-dressing brought about the necessity for investigation of the effects of other and cheaper forms of nitrogen. Consequently a start was made on two trials described on pages 342 and 343.

FARM OF J. F. DAWSON, FERNSIDE.

This experiment was laid down on 31st May, 1928, and harvested on 30th January, 1929. Variety of wheat, Solid-straw Tuscan. The previous crop was barley. The treatments used per acre were as follows:—

- (1) No manure.
- (2) Nitrate of soda (15.5 per cent. nitrogen) 1 cwt.
- (3) Superphosphate (44-46 per cent. tricalcic phosphate).. .. 1 cwt.
- (4) Super 1 cwt., plus nitrate of soda 1 cwt. 2 cwt.
- (5) Super 1 cwt., plus sulphate of ammonia (20 per cent. nitrogen) 87 lb. 199 lb.
- (6) Super 1 cwt., plus calcium cyanamide (19 per cent. nitrogen) 91 lb. 203 lb.

The quantities of nitrogenous fertilizers were arranged so as to supply equal amounts of nitrogen per acre. The super was applied with the seed, and the nitrogenous manures were top-dressed on 23rd August. The results are given in the following table:—

Table 3.

(Each yield is the average of 36 plots.)

Treatments.	Yields per Acre.	Increase over No-manure.	Increase of Super plus Nitrogen over Super
	Bushels.	Bushels.	Bushels.
(1) No manure	25.3	..	..
(2) Nitrate of soda	26.1	0.8	..
(3) Superphosphate.. ..	28.7	3.4	..
(4) Super plus nitrate of soda	29.6	4.3	0.9
(5) Super plus sulphate of ammonia.. ..	30.8	5.5	2.1
(6) Super plus calcium cyanamide	31.7	6.4	3.0

NOTE.—Increases which are significant are shown in heavy type.

Comments on Table 3.—All treatments except nitrate of soda alone have given significant increases. The addition of nitrate of soda to super has not caused a statistically significant increase, although it is probably real enough. The addition of both sulphate of ammonia and calcium cyanamide to super has caused significant increases, and both Treatments 5 and 6 are significantly better than Treatment 4.



EXPERIMENTAL PLOTS ON MR. DAWSON'S FARM, FERNSIDE.

Photo taken just prior to application of nitrogen.

FARM OF D. SPENCE, SHERWOOD.

This experiment was sown on 31st July, 1928, and harvested on 9th February, 1929. The previous crop was turnips, which was preceded by three years in grass. The treatments used per acre were as follows:—

- (1) Superphosphate (44-46 per cent.) 1 cwt.
- (2) Super 1 cwt., plus nitrate of soda (15.5 per cent. nit) $1\frac{1}{2}$ cwt. 2 $\frac{1}{2}$ cwt.
- (3) Super 1 cwt., plus sulphate of ammonia (20 per cent. nit) 130 lb 242 lb.
- (4) Super 1 cwt., plus Urea (46 per cent. nit.) 56 lb. $1\frac{1}{2}$ cwt.

The quantities of nitrogenous fertilizer were arranged so as to supply equal quantities of nitrogen per acre. The super was sown with the seed, and the nitrogenous manures were top-dressed on 1st October, 1928. Results are given in Table 4.

Table 4.

(Each yield is the average of 29 plots)

Treatment.	Yield per Acre.	Increase over Super due to Nitrogen.
	Bushels.	Bushels.
Superphosphate	19.9	..
Super plus nitrate of soda	30.0	10.1
Super plus sulphate of ammonia	27.8	7.9
Super plus Urea	25.6	5.7

Comments on Table 4. All increases due to nitrogen are significant. Both nitrate - of - soda and sulphate - of - ammonia treatments are significantly better in yield than Urea. The difference between nitrate-of-soda and sulphate-of-ammonia treatments is not significant.

GENERAL REMARKS.

The results set out in Tables 3 and 4 must be taken as reliable only for the particular conditions in each case. The fact that sulphate of ammonia is better than nitrate of soda in one trial and the reverse in the other, though not to a significant extent, indicates the nature of the variations likely to occur. Season and time of application are important factors to be considered. The former cannot be controlled, but the latter is a matter, among other things, for a great deal of investigation. The best time to apply nitrate of soda is not likely to be the best time to apply sulphate of ammonia or other form of nitrogenous fertilizer.

Demonstration of Effect of Nitrogen.

In order to focus the attention of wheat-growers on the use of nitrogenous fertilizers, and to demonstrate the advisability of farmers giving spring dressing with nitrogen a trial, a special scheme was adopted. About two hundred roadside paddocks were selected, as follows: (1) North of Rakaia River, approximately ninety; (2) between Rakaia and Rangitata Rivers, approximately fifty; (3) between Rangitata and Waitaki Rivers, approximately fifty; (4) North Otago, approximately ten. Small plots of 1 chain by $\frac{1}{2}$ chain, situated

in a prominent place, were dressed with nitrate of soda and sulphate of ammonia alternately, at 1 cwt. per acre. Each plot was marked with a small notice-board.

At harvest farmers were requested to harvest small plots of somewhere in the vicinity of 1 chain by 7 coulter from the nitrogen-treated plots and from the adjoining untreated. A large number of farmers carried out the necessary harvestings, which were threshed with the Department's machine. The areas harvested in this way, fifty in number, were distributed as follows: (1) North of Rakaia River, forty-five; (2) between Rakaia and Rangitata Rivers, two; (3) between Rangitata and Waitaki Rivers, three; (4) North Otago, no facilities for threshing so none harvested.

Considerable errors occurred, due to differences in natural fertility of the soil, but the following data are probably not far from the truth:—

Average yield per acre of plots not treated with nitrogen	32.4 bushels per acre.
Average increase on plots treated with nitrogen	4.8 bushels per acre.

Of the fifty trials harvested, forty of the nitrogen-treated plots showed increases, while ten had yields below those of their corresponding plots without nitrogen. The average increase of 4.8 bushels per acre is in fairly close agreement with the increase from twelve carefully conducted trials shown in Table 2.

Summary.

(1) Superphosphate at 1 cwt. per acre has been responsible for increasing the yield of wheat in every one of thirteen experiments (including Dawson's, Table 3). The average increase over no-manure in twelve trials, as shown in Table 1, is 6.1 bushels per acre.

(2) Super has proved definitely superior to the other forms of phosphate used in a number of trials, and in no case has any other phosphate proved better than super.

(3) Nitrate of soda, top-dressed at 1 cwt. per acre on crop sown with super, gave increases in nine out of twelve trials. The average yield from the twelve trials was 4.4 bushels per acre better than when super alone was used. Other forms of nitrogen caused increases as shown in Tables 3 and 4. The increase due to nitrogen, expressed as the average of fifty small-plot trials, was 4.8 bushels, and in close agreement with that from the twelve trials mentioned above.

(4) Muriate of potash added to super gave significant increase in only three out of twelve trials. When used in conjunction with super and nitrate of soda it did not cause any significant increase, and in four cases actual depression in yield occurred.

The valuable assistance of farmers providing land and assistance in carrying out these trials is much appreciated. In addition to the officers mentioned at the beginning of this report the work of Instructors A. G. Elliott, W. Stafford, and K. Montgomery must be duly acknowledged. In the statistical examination of results Miss P. M. Woolf did her part expeditiously and well.

THE CARE OF DAIRY CALVES.

PREVENTION AND TREATMENT OF INTERNAL PARASITES.

J. E. McILWAINE, M.R.C.V.S., Animal Husbandry Section, Live-stock Division

It often happens where an area is set aside as a calf-paddock for several seasons that sooner or later the calves depastured thereon show symptoms of parasitic trouble. Low-lying paddocks or those subject to flooding should never be used for calves, and overstocking, especially in the late summer and autumn, should be avoided. Where a paddock is known to harbour parasitic larvæ, radical measures should be adopted. The paddock requires to be vacated and ploughed, with a liberal dressing of lime. Drainage also assists considerably in low-lying paddocks.

The symptoms shown by parasite-infested calves are wasting, anæmia, coughing, and diarrhœa. Persistent coughing, with the tongue protruding slightly from the mouth, is characteristic of parasites in the bronchial tubes of the lungs. Cattle up to two years of age may be affected with the lung-parasite. In many cases young heifers which have not been well fed and cared for are suspected of tuberculosis, when lung-parasites are the cause of the coughing and other symptoms shown.

Several methods of treatment are adopted for the eradication of lung-parasites in calves, but it must be emphasized that the best treatment is prevention, and this can be effected by careful management and good feeding. Without extra feeding even medicinal treatment will not yield very satisfactory results; in fact, there is no time in the animal's life when good wholesome food of a productive nature will yield a more satisfactory return than when it is affected with parasites. The food recommended is a mixture of equal parts of crushed oats and linseed nuts, allowing 2 lb. per head per day until all symptoms of the disease have abated. Other feeding-stuffs such as bran or crushed peas and beans may be utilized, but in extensive trials crushed oats have given better results than most other feeds.

Among other forms of treatment practised is fumigation with volatile antiseptics and sulphur, and the injection of medicinal agents direct into the trachea. In some of our dairying districts a rather common practice is to pour a little chloroform or ether into the affected animal's nostril with the object of killing the worms in the bronchial tubes. The worms are later expelled by coughing.

When parasites are present in the stomach and intestines of calves, scouring is a frequent symptom in addition to an unthrifty appearance and anæmia. The animals are usually in poor condition, sometimes pot-bellied, and frequently weak and careless about feeding. Such was the condition of a herd visited by the writer in the early winter of last year. A post-mortem examination was carried out on an animal which had recently died. The parasites were so small that they could not be seen easily by the naked eye. A section of the bowel from the calf was forwarded to the Veterinary Laboratory at Wallaceville, and the report showed that numerous parasites were embedded in the bowel-wall.

The treatment adopted in this herd was weekly dosing with two tablespoonfuls of turpentine in half a pint of milk. The animals were already receiving a ration of hay, as green feed was scarce, and in addition a ration of equal parts of crushed oats and linseed nuts was advised, allowing 2 lb. per head per day. No further losses occurred, though the infestation was a severe one. Without the special feeding the animals would not have survived. A mere allowance of hay in such cases does not in itself supply enough nutriment to the body.

In parasitic trouble a change of pasture immediately after treatment and at frequent intervals is very desirable.

ABSENCE OF CORRELATION BETWEEN ABORTION AND TEMPORARY STERILITY IN DAIRY COWS.

C. S. M. HOPKIRK, Officer in Charge, Veterinary Laboratory, Wallaceville.

THE following analysis of results of a blood agglutination test on a Taranaki dairy herd shows the absence of correlation between the two diseases abortion and temporary sterility. Such a history is typical and is used as an illustration, being one of many similar cases noted.

In this herd there was a history of seven abortions and one retained membrane last winter and spring, and considerable temporary sterility in the past season. Sixteen cows held to first service, nineteen returned to more than one service, while five are still empty. Of sixteen cows affected with abortion eight held to first service, while eight unaffected cows also held. Of the nineteen cows returning to the bull, eight were reactors to the abortion test, seven were unaffected with abortion, while the blood of four cows was too broken down for a test to be made.

Two bulls were used—M and S. M got eleven calves for thirty services, and S got nineteen calves for fifty-two services. Both bulls were free from abortion trouble, and averaged only 35 per cent. efficiency. Bull M got seven cows in calf to first service, four of those being abortion-infected and three not infected. Of the eleven which returned to him five were affected with abortion, two were healthy, and with four the test was not known. Bull S put nine cows in calf at first service. Four were affected with abortion, and five were healthy. Eight cows returned to this bull—three affected with abortion and five negative.

FERTILIZER SAMPLES FROM FARMERS.

FARMERS and other users of fertilizers are invited to forward to the Chief Chemist, Department of Agriculture, Sydney Street, Wellington, samples of any fertilizers they may purchase. Each sample should be of 1 lb. to 2 lb. weight, taken from a number of bags, and should be accompanied by the vendor's invoice certificate, showing the guaranteed composition, for comparison with the analysis. In case of a deficiency being shown by analysis, no action against the vendor will be taken in respect to any such informal sample, but arrangements will be made to collect official samples by an Inspector under the Fertilizers Act.

SEASONAL NOTES.

THE FARM.

PROVISION OF WINTER AND SPRING FEED FOR DAIRY COWS.

INADEQUATE winter and early spring feeding of cows is a common cause of low production in dairy herds. A cow calving in good condition and properly fed after calving will quickly reach her maximum production, whereas one calving in poor condition takes some time to reach her maximum yield of milk, for instead of converting her feed into milk she at first uses it to regain condition lost during the winter. Adequate feeding in the winter and spring is most important if a long high-producing lactation period is to be obtained from the cows.

In North Island dairying districts the modern tendency in grass farming is in the direction of close subdivision, heavy top-dressing, and the provision of supplementary feed for periods of grass shortage by means of hay and ensilage saved from the surplus summer production of grass. Cows in milk require feed rich in protein—that is, having generally a narrow nutritive ratio, such as young pasture grass. In order to provide sufficient protein-rich feed for the early spring it is usually necessary to save a considerable amount of the winter growth of grass by almost completely maintaining the cows during their dry period on hay, ensilage, and roots.

The autumn and early winter production of grass can be increased by the autumn top-dressing of pastures with phosphates, and early autumn top-dressing is becoming a feature of dairy-farm management. On rye-grass pastures the autumn and early winter growing-period usually extends to the end of June and July, while August and early September are months of normally poor growth of rye-grass. If dairy cows are to have a long, high-producing lactation period they must calve in July or early August, and the provision of young grass for early-calving cows from mid-July to mid-September is an important problem in dairy-farm management.

Grass from mid-July to mid-August can generally be obtained by shutting up some fields in June, catching the last of the winter growth of rye-grass, and holding this till the cows calve. Young grass from mid-August to mid-September can be obtained by the use of nitrogenous fertilizers, but whether the extended use of these for providing early winter feed is payable has not yet been definitely decided. In experimental work conducted during the past season the increase in the production of early spring grass from winter applications of nitrogenous fertilizers has been sufficiently satisfactory to warrant dairy-farmers trying them out on a small scale. The value of nitrogenous fertilizers in producing early spring feed can be best judged by shutting up two small fields in the winter, both of which have had the same phosphate treatment, and one in addition a dressing of nitrogen.

The efficacy of nitrogen in producing early spring feed varies considerably, depending on the type of pasture and moisture and shelter conditions of the field, and it is most efficient on well sheltered and drained fields the pasture of which is dominantly rye-grass. The best

time to apply nitrogenous manures in the winter has not yet been definitely determined, but it should be carefully borne in mind that there is no hope of the use of nitrogenous manures being a payable proposition unless the whole of the extra grass produced by them is turned into butterfat. Rye-grass pastures shut up in June will provide feed for cows calving in July, and applications of nitrogenous fertilizers to the fields shut up at this time will only be warranted if sufficient cows calve to use the whole of the extra grass-growth for milk production. The average farm is shortest of pasture feed from mid-August to mid-September; applications of nitrogen in July will increase the grass-growth at that period, and at present July would appear to be the most suitable month for the general application of nitrogenous manures. However, if the use of nitrogenous fertilizers in the winter is later shown to be a payable proposition, then the ability of the dairy-farmer to use them extensively for the stimulation of the early spring growth of grass will lead to the earlier calving of herds; hence the need for earlier applications of nitrogen, and June may be shown to be the month when the first winter applications should be made.

DRAINAGE.

June is a suitable month in which to finish the cleaning-out of all open drains and to carry out any tile-draining work that may be necessary. Before starting to tile-drain a field the plan of the proposed drains should be carefully worked out. The main line of tiles should follow the line of natural drainage where water collects. A parallel system of drains is suited to flat-lying land with a gentle slope in one direction. It is usually convenient to have the laterals running parallel to the fence-lines and to the "finishes," in order to give supplementary surface drainage in the same direction. Lateral drains should enter the main drain at an acute angle, and should in no case enter opposite sides of the main drain at the same point, but a few feet of space should always intervene, so that the flow of water in the main drains will not be checked by the meeting of two opposing currents. With a poor fall the lateral drains should not be more than 10 chains long; with a good fall—say, 4 in. per 100 ft.—they may be 15 chains. To efficiently drain very stiff clays the parallel drains may require to be 20 ft. apart; on moderately heavy soils 30 ft. to 60 ft. apart. Should springs be discovered in any part of the field it will be found advantageous to remove their water by special drains distinct from the regular system and at a greater depth, so that none of the spring water may be permitted to diffuse itself through the soil.

Tile draining is very costly, and many of the benefits of thorough drainage can be obtained less expensively by mole drainage. A strong, firm clay or loam, free from stones, offers the greatest facilities for mole drainage. It is essential that the subsoil be of even texture. The surface of the field need not of necessity be perfectly flat or even, for the mole-plough may be raised or lowered to some extent to suit the irregularities of the surface, but it must admit of a moderate and fairly uniform fall being given throughout the length of each drain.

The mole-plough consists essentially of a broad, flat coulter on the bottom of which is a pointed sock, and the mole which is attached to the bottom of the coulter behind the sock. The main drain is cut

in the ordinary way on the lower side of the field, and is usually laid in pipes. The main should be 6 in. to 9 in. deeper than the mole drains, so as to facilitate the discharge of water into it. The lines of the drains are usually 15 ft. to 30 ft. apart, and if the field has been ploughed in lands the drains are usually cut up the "finishes." When the main drain has been dug the mole is dropped into the open branch and drawn to the higher side of the field; when it reaches the end of the drain a pin is knocked out of one end of the coulter and the mole comes out of the ground. The plough is then drawn back to the lower side of the field and starts again at the next branch. A mole-plough will make about four miles of drains per day. In suitable soils the drains will last from fifteen to twenty years.

—*P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.*

THE ORCHARD.

PRUNING OPERATIONS.

THE season having come round for the annual pruning the work should be proceeded with now, and every opportunity taken to push it forward in order to ensure its completion in good time. Too frequently one sees spring ploughing and cultivation, and even the earlier sprayings, delayed or omitted on account of the pruning operations being too protracted.

Pruning is only one factor in successful fruit-production, and although an important one in securing a balance between healthy wood-growth and normal fruit-production, it does not necessarily follow that success can be achieved simply by using judgment and skill in pruning. The other important factors more or less controllable by the orchardist—namely, soil-fertility, cultivation, disease-control, thinning, shelter, and drainage—must each receive due attention. It is only by thoroughness in each that a full measure of success can be secured.

The main objects in pruning are to establish a strong framework and secure a tree of good shape in the building-up of young trees, in older trees to help maintain vigour and regulate fruit-production, and to generally renovate old trees. Although much has been written about pruning and a vast amount of detail given, it is more or less confusing to a beginner. In every style or system two main principles must be adhered to—firstly, thinning out to secure good distribution of light and air; secondly, a shortening-in of various growths to maintain vigour and stability. The practice of pruning as applied to fruit-trees must necessarily be varied according to their age, vigour, variety, and condition generally. It resolves itself into a matter of exercising judgment in treating individual trees in the orchard after reviewing the previous season's results.

Stone-fruits.

Stone-fruit trees lose their foliage before pip-fruits and shoot into growth earlier, so it is wise to prune these first and secure the advantage of an early start. The various kinds of fruit differ in their fruiting-habit and so require varied treatment.

Peaches and Nectarines.—The fruiting-habit of the nectarine is identical with that of the peach. The peach bears its crop entirely on one-year-old wood, consequently it responds to correct pruning and readily declines with neglect. It is necessary to prune peach-trees more heavily than most other fruits in order to maintain a constant supply of fruit-bearing wood. Unless abundance of good vigorous shoots are produced each year a peach-tree may be considered to be in an unthrifty condition, and fruit-production is doubtful. The natural habit of the peach is to carry its bearing area higher each year, leaving unfurnished non-fruiting branches. The natural denseness of the peach-foliage makes it difficult to maintain a good distribution of fruiting-wood in the interior of the tree. Thinning out to ensure adequate light reaching all parts is necessary to ensure the production of fruiting branches on the lower limbs. Long laterals for fruit-bearing should be encouraged, and may be frequently shortened and renewed by cutting back to a new lateral. Trees should be thinned of superfluous branches to secure form, and fruiting-wood should be reduced considerably, so that the crop which is likely to set will be well distributed and will not be so heavy as to impose too heavy a task at thinning-time. It is generally more economical to reduce the crop as much as possible during pruning than entirely by hand thinning later. The reduction of fruiting-wood may be accomplished by thinning out. The heading-back of new shoots, especially on varieties which bear only on the tip or outer half, is undesirable. The proper amount of fruiting-wood should be obtained by thinning out unbranched one-year-old fruiting-shoots, and cutting back moderately to laterals fruiting-shoots that are branched. It is advisable to cut to well-ripened stocky laterals rather than to slender shoots.

Apricots.—The apricot produces the bulk of its fruit laterally on spurs which are relatively short-lived. A relatively small portion of the crop is produced on one-year shoots. The pruning system must be such as to cause the continual renewal of the fruit-spur system. Branches should not be allowed to become too long and unbranched. This condition may be avoided by cutting back to laterals. A fairly vigorous growth should be maintained, and as the tree becomes older and only short growth follows a thinning system of pruning, more severe treatment by way of cutting back may have to be resorted to in order to maintain the vigour of the tree.

Cherries.—Cherries are borne on long-lived spurs—ten to twelve years—consequently less renewal of fruiting-wood is required, probably less than on any other deciduous fruit-tree. Once the tree is brought into bearing little pruning is necessary to maintain it in a productive condition. The pruning which is necessary should be done annually, and should be of sufficient severity to renew approximately 10 per cent. of the fruit-bearing area each year. New growth is mostly from terminal buds; therefore, unless some heading is done, there is a tendency to develop long pole-like branches. Moderate cutting back of leaders for four or five years or until the framework is completed is necessary. Further heading will cause delay in fruiting, as encouragement to make shoot-growth by heavy cutting will render fruit-spur development impossible. Cherry-trees are particular as to conditions under which they will thrive. Reinvigorating of weak trees is not readily brought about

by the mere adoption of a sound pruning method. Proper soil-conditions must be maintained in order to keep a bearing cherry-tree in a good state of vigour. When cutting back is found necessary for any particular reason, care should be taken to cut to a lateral when possible. Trees showing die-back of leaders can sometimes be rejuvenated by severe pruning. It is imperative, however, that soil-conditions be improved at the same time.

Japanese Plums.-- These plums are borne laterally upon short thick spurs, mostly on wood two years and older. A small proportion of the crop is produced on one-year wood, mostly at the base of strong shoots. The fruit-bearing habit is similar to that of the apricot, the principal difference being that the spurs on the Japanese plum are longer-lived. On account of their prolific bearing, and as only large fruits are of commercial value, fairly heavy pruning must be resorted to, in order to reduce the fruit crop and to induce sufficient growth of new wood.

European Plums.--European plums do not tend to overproduce as do the Japanese varieties, hence a lighter pruning with the idea of favouring bud-production is sometimes necessary, rather than a heavy pruning to reduce the amount of fruit-producing spurs. Most of the pruning would consist of removing worn-out portions and cutting out broken branches.

Notes on the pruning of pip-fruits will be provided for next month.

--N. J. Adamson, Orchard Instructor, Hastings.

Citrus - culture.

Shelter : This season's autumn weather conditions have been favourable to growth, resulting in citrus-trees being furnished with an abundance of new growth. There are few situations where this growth will not be affected by the rigour of the winter wind or frost. With adult trees the damage is not generally severe, though it pays to afford what shelter is possible by maintaining the shelter-belt in good order. Though it is most difficult to establish young undergrowth in an old shelter-belt, a breakwind of brushwood may be erected in the vacant spaces of the line and afford the required shelter. With young trees planted one or two years more local shelter is generally required. Where such cover-crops as lupins are grown these often afford the shelter required, but under other circumstances a wigwam of brushwood or maize-stalks should be built round the tree, open to the north-east and north and drawn together overhead. In unprotected places where damage from frost or cold wind occurs the damaged parts should not be cut away until the arrival of more open weather in the spring, for although they may be unsightly they afford some protection.

Drainage : During the rainy season every care should be exercised to ensure that no stagnant water is allowed to remain on or in the land.

Spraying : An application of 4-4-40 bordeaux is advisable at this time of year for verrucosis and grey scab on fruit and foliage. This spray also has the effect of hardening the foliage to better withstand low temperatures.

--W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

THE BREEDING-HENS.

THE month of June may generally be regarded as one of the slackest periods in the poultry-keeper's year. Nevertheless there are several matters which will require attention, in addition to the ordinary routine work, if the stock and plant are to be maintained at a high standard of efficiency.

In the first place the prospective breeding-hens require to be specially fed and managed, in order that they may be in proper breeding condition at the time of mating. If good hatches and strong chicks are to be produced it is of the first importance that the hens are not allowed to become too fat. This does not imply that the birds should be placed on a starvation ration, but rather that they be fed according to their condition, and managed in such a way that they will not put on a surplus of interior fat. When hens are moulting, and until they are nearing a laying-point, they are usually disinclined to take much exercise. Thus, if they are provided with an abundance of food which can be secured with little or no effort, the formation of bodily fat will result.

This applies particularly after the birds have recovered from the moult. At this time they should be frequently handled for the purpose of ascertaining their condition. If they are found to be beyond a desired weight the only safe course is to provide a whole-grain ration, and in a manner which will compel the birds to exercise—that is, fed in a deep litter. Indeed, from now on until the termination of the breeding season the birds will retain a better breeding condition if the mash diet is entirely eliminated from the ration. This refers particularly to birds which are being kept under more or less confined, artificial conditions, for where a good range is available, particularly a free range, nothing better can take its place in providing healthy exercise and ideal conditions for breeding-stock. In all matters pertaining to breeding it is well known that nature's methods cannot be improved upon. Thus the best we can do with breeding-birds is to follow nature as closely as possible in the matter of feeding and management. If one could dissect a fowl's crop after a day on free range it would demonstrate nature's demands in feeding. We would not find any one particular class of food, but in most cases it would consist of a naturally balanced ration of different seeds, green stuff, worms, and various kinds of insect life.

Thus in cases where birds are being kept under confined conditions the ration should consist of a variety of whole grains. The greater the variety provided in this respect the greater will be the production of fertile eggs, the stronger will be the germs, and the more easy the chicks will be to rear. A chicken is made up of many constituents, and the food provided to the parent birds must contain these elements which are necessary for the formation of a properly developed chick. A variety of grains, an abundance of greenstuff, a spare ration of animal food, and provision for ample exercise are among the chief requirements for the maintenance of proper condition in the bird producing eggs for reproduction purposes. While there is little or no danger of overfeeding a heavy-laying bird with the right class of food, provided she is given an opportunity of taking plenty of exercise,

there is a grave danger of overfeeding the breeding specimen just before or when producing eggs for hatching purposes. Where market eggs only are being produced the birds can be forced with meat, milk, &c., and as a result the formation of surplus fat will be discouraged. Such treatment, however, would be a mistake where the breeding-bird is concerned, for if a highly forcing diet is provided trouble is almost sure to be experienced in the hatching and brooding operations.

For any other purpose for which fowls are kept I believe in feeding them well, but in the case of breeding-birds it may be necessary at times to depart from this rule. If they are putting on much surplus fat it will probably be found a wise course to slightly reduce the ration in order that they may be maintained in a more or less active lean condition.

THE BREEDING MALF.

While it is necessary that the hens should be maintained in the best possible condition, it is of equal importance that the male bird should be well treated, so that he may be in the best of form at mating-time. Usually male birds are more subject to infestation by lice than are hens, and are less likely to avail themselves of dust baths. For this reason they should be frequently dusted with insect-powder, or treated with Black Leaf 40 as recommended in a previous issue of the *Journal*. Male birds which carry large combs and wattles, which are common in such breeds as Leghorns, Minorcas, &c., should have these removed before being placed in the breeding-pens. As a result of this slight operation a bird will usually fertilize more eggs and produce much stronger germs. The operation can be simply performed by means of a pair of sharp scissors, a good dressing of iodoform being applied to the cut parts to prevent bleeding and other such after-effects. Long spurs on the male bird are another common cause of infertility of the eggs, and often result in hens having their sides badly ripped. The points of the spurs should be removed with a fine saw to within, say, $\frac{1}{2}$ in. of the shank, and if a little Stockholm tar is dabbed on the surface of the cut little or no bleeding will result.

PREPARING INCUBATORS AND BROODERS.

Another matter that should be attended to now is the careful examination of incubators and brooders to see that they are in thorough working-order. It may be found that fresh burners for incubator lamps are required, and new connecting-rods for the machines where the old ones have become bent, or set-screws which have become worn and liable to cause a serious accident at any time. A new thermometer to suit some special make of incubator may be required. Where these and other duplicate parts of incubators or brooders are required it is a mistake to leave the purchasing until the last minute. In point of fact, everything should be done to ward off possible trouble when the busy season arrives. Even for some of the most popular makes of incubators and brooders duplicate parts are not procurable in this country, and if these have to be brought from overseas it may easily mean an incubator or a brooder having to remain out of commission during the whole or part of the hatching season, merely because some essential is unprocurable when required.

—F. C. Brown, Chief Poultry Instructor, Wellington.

HORTICULTURE.

TOBACCO-LEAF.

A DISAPPOINTING feature in many tobacco crops of the past season was the number of blank spaces at harvest-time. A patchy crop of this class is a great economic waste, as it requires almost as much labour to handle it as an even crop. In some instances the blanks were filled late, with the result that that portion of the crop was unripe at the harvest period, and the labour was seriously increased and many difficulties created. In the great majority of cases this loss can be avoided with proper management.

One of the worst causes of this misfortune is the late and hurried preparation of grasslands for tobacco-culture. Where such lands are to be used the turf should be skim-ploughed now and cross-ploughed later when the turf has rotted. This early preparation exposes the larvæ and pupæ responsible for killing the young tobacco plants, and insect-eating birds, which are rather short of food at this season, follow the operation very closely, and do good work in cleaning up the pest. The capsules in which the insects lie dormant before emerging in the spring are also disturbed and destroyed, so that this ploughing, together with the cultivation which follows, effectively cleans the land of pests, as well as weeds, which embarrass the grower later if the tillage is neglected. This is the first important step in the production of a good tobacco crop.

Another matter requiring urgent consideration is that of shed accommodation for air-drying. Farm-sheds may be used successfully for the early crop, but they must be dry, or mildew will spoil the leaf. It takes about 10,000 cubic feet to house one acre of plants; thus a building 25 ft. by 16 ft. by 100 ft. should accommodate 4 acres of tobacco. This accommodation is the limiting factor of production, and it is important that this should be recognized, as much confusion will be avoided, and well-cured leaf may be obtained economically where this provision is well considered. Most farm-sheds are well ventilated, and serve the purpose for the early crops; for later use they are often too exposed for obtaining the best results without further protection of the stocks from the effects of cold and humid weather. Some iron buildings used are insufficiently ventilated for this purpose, which requires ample ventilation in the roof and also near the ground so that effective ventilation may be given as required. Most of the difficulties experienced in new districts would be avoided if sufficient and suitable provision of this kind were made.

PRUNING OF BUSH-FRUIT.

At the present time consideration should be given to the pruning of bush-fruits. It is a tiresome business, and it is often neglected. Gooseberry-bushes become overgrown with small berries and difficult picking results, while currant-bushes are allowed to grow high and the young wood is short and weak. In suitable districts these are profitable crops if a definite policy of pruning, spraying, and feeding is adopted. In both crops the best fruit is grown on the young wood, so the main principle in pruning is to preserve well-spaced young wood, and cut old wood well back to a bud that will provide young wood for another year. If this is done the bushes remain vigorous,

and the fruit is of good size and easily handled. As birds sometimes feed on the buds of these plants, it is customary to delay the actual pruning until late in the winter. In most districts pruning should be commenced towards the end of this month.

TOMATOES UNDER GLASS.

Towards the end of the month also another season commences for the tomato crop grown under glass. For this purpose a hotbed in a glass-house is generally used for starting the seeds. The hotbed should be made of fresh stable manure, and in these days of short supplies it is well to remember that the fallen leaves in shrubberies and plantations can be included. The heat, of course, is obtained from the fermentation of the material, and the amount of heat and the period will depend on its preparation. Very commonly the materials are placed in position as received, and the heat obtained is very little, unevenly distributed, and of brief duration. This is because the operation of fermentation is taking place in small patches and is checked on reaching dry material.

The full benefit of the method is obtained by setting up a steady fermentation throughout the whole mass before placing it in position. This is done by placing it in a compact heap to start the fermentation. In four or five days this will be established, and the heap should be turned over and shaken out to mix it, at the same time watering all dry portions as the work proceeds. After a similar period this operation should be repeated, and after about the same period has elapsed again the material should be evenly moist, and the bacterial action of fermentation should be in operation throughout the whole mass. It is then ready for building the hot-bed. Shake the material out and tread it down firmly. In about four days water the bed well and it is then ready for use.

A temperature of 55° to 60° F. should be maintained in the seed-boxes; covering them with a sheet of glass to retain moisture while the seed is sprouting is a very usual custom. A sheet of paper over the glass also provides useful shade.

PREPARING LAND FOR SPRING PLANTINGS.

In preparing the land for spring planting very deep ploughing has not always the results that are anticipated, and on land with a clay subsoil, or where such ploughing has not previously been practised, it is often better to follow the surface ploughing with a subsoil-plough, or the subsoil may be broken up to some extent by an attachment on the heel of an ordinary plough without bringing this lower stratum to the top. Certainly much land would be greatly improved for this purpose if it were deeply ploughed in this way more frequently. Preparation at this time affords an opportunity of turning in organic manures, and it is commonly done, but most of the large quantities of blood-and-bone manure used could also be applied and turned in deep at the present time with advantage. A good surface dressing of basic slag and kainit harrowed in after ploughing would be a good change of treatment for some lands and put them in good order by the time the spring planting season arrived. The surface is best left rough at the present time, especially in the case of stiff lands inclined to set or form a crust.

IMPORTANCE OF STRAIN IN SEED.

There is a demand for all classes of seeds, but the commercial grower should go to no end of trouble to get the best. Time, land, and labour are often spent in growing, say, a crop of cauliflower that does not pay for any one of those items of cost. Usually the variety is well chosen but the strain is poor. The experience and care spent in raising and maintaining high strains of seed is well worth the extra price, and no one renders a better service to the trade than seed-growers and distributors of this class. Seed potatoes of pure and sound quality have been notoriously difficult to obtain, but the Government-certificated seed that is now available affords a supply that every commercial grower should draw upon as far as possible.

—W. C. Hyde, *Horticulturist*, Wellington.

THE APIARY.

WINTER PRECAUTIONS.

BEFORE the cold weather sets in every hive should be examined, in order to make sure that the frames are completely covered with sufficient dry, well-fitting mats to keep the bees protected. Wherever a damp or mouldy mat is discovered it should be replaced with a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. Be sure they are placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and will in time absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter if they are expected to prove in normal condition in the spring. Should no permanent shelter be available, something temporary should be erected. Manuka scrub is excellent for making a temporary wind-break.

Weeds and grass should be kept down. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

TREATMENT OF WAX.

After the honey crop is disposed of and the bees are settled snugly in their winter quarters the beekeeper should give attention to clarifying his wax. Where a solar extractor has been used during the summer it will be a simple matter to collect the cakes of wax which have been melted in this manner and reduce them to one or two large cakes; but where a number of combs are to be treated a wax-press is an almost indispensable article in the apiary equipment. For handling wax in large quantities the press now known as the Root wax-press is best. No special building is needed for wax-melting; an ordinary washhouse answers the purpose admirably. Choose a cold day for the operation, since nothing excites the bees during the off season like the smell of hot wax.

Commencing operations, fill the copper half full of water, and when this is heated place the combs— which must have been removed from the frames—in the hot water. Have a strong stand ready to support the wax-press, and inside this place a kerosene heater, so arranging it that the flame comes in direct contact with the bottom of the press. Fill the water-compartment of the press with boiling water, which the heater will now keep boiling, and in the perforated basket of the press place a coarse scrim bag large enough to reach to the bottom of the basket. The combs in the copper should be stirred with a stick until the wax is all melted, and the contents of the copper—water and wax—should then be ladled into the scrim bag in the press. The top of the bag should now be folded, so as to allow of one or more of the wooden “followers” belonging to the press to be placed on top of it and the screw placed in position, when a stream of water and wax will immediately commence to flow from the outlet provided in the press. A kerosene-tin or similar vessel should be placed in position under the outlet.

Two precautions are necessary in using a wax-press. Pressure should at all times be applied with caution. Until the flow from the press slackens the screw should not be turned, and when it becomes necessary to apply pressure this should be done without appreciable effort. The screw should always turn easily. It will be found that if this advice is taken the maximum of wax will be obtained with very little risk to the machine. Another point to be borne in mind is that only a comparatively small quantity of water and wax must be put into the bag at each ladling. It is difficult to estimate exactly how much to treat at once, so much depends on the proportions of wax and water, but on no account attempt to fill the scrim bag at one operation. When the wax and water cease to run from the outlet the bag should be removed and the slumgum emptied out before the press is required to deal with any more wax. The wax should be set aside to cool as gradually as possible, this being best achieved by covering the tin containing it with corn-sacks or similar material. The gradual cooling helps to clarify the wax. When it is quite cold the cake should be taken out of the tin and carefully scraped.

The tin should now be washed out and partly filled with clean hot water, the cake of wax replaced, and the whole gradually heated until the wax is once more melted. After this second process the whole should be slowly cooled as before, and when the wax is once more removed and scraped it will have reached its commercial form. The wax-press and copper should be cleansed while still hot. The water should be emptied out of its compartment in the press at once, and the press placed to drain in order to prevent rust. The slumgum must be gathered up and burnt, and the bag washed and dried for future use.

BEEKEEPERS' CONFERENCE.

The annual conference of beekeepers will be held at Timaru on 5th and 6th June. Delegates from all parts of the Dominion will be present. Papers in connection with the Hopkins Memorial scheme will form a feature of the conference. This year's subject is “How to produce good queens of proved producing strain.” Arrangements have been made for an excursion to Mount Cook at the close of the conference.

E. A. Earp, Senior Apiary Instructor, Wellington.

REVIEW.

Minerals in Pastures and their Relation to Animal Nutrition. By J. B. Orr, D.S.O., M.C.M.A., D.Sc., M.D. London, 1929. H. K. Lewis and Co., Ltd. Price in Great Britain, 10s. 6d. From the Reid Library, Rowett Research Institute, Aberdeen.

THIS is a book which every well-read farmer should have on his bookshelf, for it is a painstaking attempt to bring together and set down in simple language all that is known in this difficult field of agricultural science. A very devoted band of high British experts, well known from their past efforts in the cause of agricultural science, is at present constituted, together with certain Government officials, as a sub-committee of the 1926 Civil Research Committee of the British Cabinet. The duty of this sub-committee is to consider and report on the relationship between the mineral content of pastures and their nutritive value. Among the members are Sir A. D. Hall, Sir Thomas Middleton, Professor T. B. Wood, and Dr. J. B. Orr. Major Walter Elliot, M.B., D.Sc., the chairman, is Parliamentary Under-Secretary of State for Scotland, and brings to the task of presiding over the committee much knowledge of a varied kind, for he holds medical and scientific diplomas, has had military and farming experience, and possesses a reputation for administrative ability. He is a skilful debater, and is always listened to with interest by that most critical of audiences, the House of Commons.

Major Elliot contributes a preface emphasizing the importance of research work into the mineral content of pastures, and indicates the steps the Imperial Government are taking to organize this investigation on an Empire-wide basis. This committee recommended that an important part of the investigation should consist of a search of the literature, and to collect and arrange in an easily accessible form all the available information bearing on the subject. The information having been printed was circulated to all workers in that branch and officials interested, and the present book is the result.

A pleasantly written foreword by Professor E. P. Cathcart, the well-known authority on nutrition, tells that Major Elliot's interest in the matter was first aroused by the high death-rate and disease in Highland sheep, which later was proved to be largely due to mineral deficiency in the herbage. Dr. Cathcart emphasizes the value of Dr. Orr's work, and concludes with the interesting thought that the antiquity of the phrase "the salt of the earth" testifies to the esteem in which the mineral constituents of nutrition have always been held. Dr. Orr in an opening note explains how he consulted other workers in writing this book, which he modestly terms a review, and how he has taken pains to visit most of the workers scattered all over the world in their own laboratories, research stations, and farms, and how much he has enjoyed getting into personal touch with the overseas researchers.

In the first chapter are given the reasons why this great team-work concerning minerals in pastures has been set on foot by the British Cabinet, supported by grants in aid from the Empire Marketing Board to workers in Britain, Australia, New Zealand, and East Africa. Pasture and its derivatives, hay and ensilage, are the main food of the domesticated herbivora. The amount of grassland products annually consumed in Britain is valued at £426,000,000, more than one-half of which products are imported. This amount is nearly one-quarter in money value of the total imports into Britain. The importance of the research to New Zealand is shown by the fact that of the great units of Empire the proportion of grassland products each one exports, expressed as percentages of the total exports of each, is as follows: Irish Free State, 55 per cent.; Australia, 60 per cent.; Canada, 17 per cent.; New Zealand, 94 per cent.

The importance of quality as well as of quantity in pasture is now becoming realized. Stock must have their pasture—their natural food—not only in sufficient bulk to provide for mere existence, but it should contain all the essential mineral foods in amount necessary to ensure maximum health, growth, and normal reproduction. What deficiencies of mineral foods occur and how they can best be remedied is the aim of this present crusade against ignorance.

Historical: As early as 1804 de Saussure came to the conclusion that the ash of plants varied with the nature of the soil and the plant's stage of growth. Later, Sprengel, in 1832, suggested that the ingredients of the ash of plants were of importance in the nutrition of animals. It is remarkable that these early investigators should have reached these conclusions which modern work is showing to be of fundamental importance in the nutritive value of pasture. The great systematic work done by Lawes and Gilbert (1856-1900) at Rothamsted included the chemical analysis of some thousands of samples of herbage, and brought out the important fact that "the mineral composition of the mixed herbage is very directly dependent on the supplies available within the soil. Indeed, the composition of the mixed produce was found to be a somewhat close reflection of the supply available within the range of the roots." Then in the latter half of the nineteenth century various European workers investigated the ash of hay grown in districts where endemic diseases occurred in herbivora, and more recently attention has been directed in South Africa, New Zealand, and Australia to pasture, sufficient in quantity, but which failed to sustain health or produce normal development in domestic stock. Later still came the combined attack by the Cambridge University Nutrition Institute and the Rowett Research Institute on mineral content of pastures, with reference to animal nutrition and disease (1925-26). Dr. Orr comments on the different objective of the Rothamsted analysis, on the one hand, and that of the other experimenters, on the other hand. Lawes and Gilbert experimented from the nutrition of the plant viewpoint, the others from the viewpoint of the animal for which the plant is grown. The distinction is very cogent, since the animal may suffer from mineral starvation when fed on normal quantities of perfectly healthy plants. Obviously the plant's requirements are not necessarily those of the animal. The *raison d'être* of pasture is to feed the animal; hence consideration of the animal should come first, and the pasture must be fed up to the animal's requirements or supplementary minerals fed to the animal. The percentages of minerals in different kinds of pasture are discussed from the animal's point of view—those elements present in the larger amounts in the ash, calcium, phosphorus, sodium, potassium, and chlorine; the protein and energy value; and finally the elements present in the rarer amounts—namely, iodine, iron, manganese, magnesium, sulphur, silicon, fluorine, boron, and copper—are passed under review.

Partial analyses are averaged, and the figures given for forty-eight samples of cultivated pasture expressed as percentages on the dry matter are found to compare with very highly manured and very poor deficient pastures in regard to the two chief minerals as follows—

	Calcium Oxide (CaO)	Phosphoric Oxide (P ₂ O ₅)
Average of forty-eight cultivated pastures	1.104	0.765
Lord Astor's racehorse paddocks	2.473	0.997
Poor hill pastures (eaten)	0.500	0.600
Poor hill pastures (not eaten)	0.300	0.370
Very deficient pastures—		
Isle of Lewis	0.290	0.240
Falkland Islands	0.290	0.540

Pastures low in minerals tend to be low also in protein. There is no evidence of any correlation between caloric value and mineral content of pastures. On pastures in which there is extreme deficiency of one element deficiency diseases are most liable to occur.

One gathers from a study of the whole work of Dr. Orr that the only deficiency diseases in stock so far sufficiently authenticated to cause farmers serious concern are those caused by shortage of (1) calcium, (2) phosphorus, and (3) iron. In addition to these three elements there is the case of a possible excess of potassium—an element which is present in comparatively large amounts in all pasture—in amount excessively large from the point of view of the animal, which has to eliminate the excess through the kidneys. It has been thought until recently that sodium applied as common or agricultural salt lick is required to assist this elimination, but recent work at the Rowett Institute has thrown some doubt on this supposed action of sodium.

On the necessity for giving salt as a lick to all domestic herbivora there is much better ground for dogmatizing. Both sodium and chlorine are essential mineral foods, and lack of a salt ration on the farm may result in the animal

suffering a temporary shortage when the pasture is deficient in sodium or chlorine. Chlorine appears to vary very much in pasture-samples. It is necessary in the formation of the acid gastric juice which contains dilute hydrochloric acid. The older writers and even the ancient classics extolled the use of salt, and suggested its influence in the general health and fecundity of animals. Conversely they attributed to the lack of it unthriftiness, diminished productiveness, and even, it is suggested, barrenness, or, as we should now say, temporary sterility. Apart from the use of sodium or chlorine, common salt is an excellent medium through which to give elements difficult to administer to stock such as iodine and perhaps iron.

It is sometimes difficult to induce sheep to take salt licks in New Zealand. Dr. Orr describes his pellet method of giving minerals to sheep, already described in this *Journal* and found to work satisfactorily in the two experiments tried locally (see issue for January, 1929, page 10). The method has been fully tried out in Kenya Colony and Scotland, and the results should be carefully studied by sheep-farmers on poor hill pastures. The following extract is taken from the book under review :—

" Kenya results: A mixture of inorganic salts supplying chiefly calcium, phosphorus, sodium, and chlorine, and traces of other minerals, has been fed to sheep and lambs grazing on pasture known to be deficient in these minerals. The following table shows the effect of the minerals on the rate of growth of lambs. There were forty-five lambs in each group. The group forming the control received no mineral supplement, while the other group was fed a mineral mixture at the rate of half an ounce per head per day.

	Control	Mineral Mixture.
Molo (seven months), average gain in weight in pounds	14.3	18.2
Naivasha (nine months), average gain in weight in pounds	39.7	44.2

The average weight of the fleeces of the mineral-fed lot were in the one case (Molo) about 4 per cent. and in the other 18 per cent. heavier than in the controls. Somewhat similar tests have been carried out with sheep in Scotland grazing on areas in which the chief deficiency was calcium. These tests, however, are not strictly comparable in so far as, for convenience in feeding, the minerals were made up into the form of little cubes with protein-rich substances and 5 per cent. cod-liver oil. The cubes consisted of minerals to the extent of 50 per cent., and half an ounce per ewe per day was fed for the seven months in the year when the mineral content of the pastures was known to be at its lowest. The following figures show the weight of lambs at birth at the various hill farms; there were from fifty to a hundred lambs in each group.

Weight of Lambs at Birth.

	Fed	Control Unfed.
Blairmore, Arran	7.4 lb	7.1 lb.
Benlester, Arran	8.7 lb.	7.7 lb.
Essiehill, Rowett Institute	9.5 lb.	8.7 lb
Edgerston, Single	9.0 lb.	8.5 lb.
Edgerston, Twins	7.3 lb.	7.2 lb.

" The influence on the weight of the fleece is shown by the following table :—

Weight of Fleeces.

	Fed.	Control Unfed.
Blairmore	4.3 lb.	4.2 lb.
Benlester	6.0 lb.	5.5 lb.
Edgerston ewes	4.6 lb.	4.2 lb.
Edgerston hoggets	4.8 lb.	4.3 lb.
Watcarrick	3.7 lb.	3.3 lb.
Terrona	3.8 lb.	3.5 lb.

" The results of these Scottish tests, therefore, are closely similar to those obtained from Kenya Colony."

The important thing to remember is the comparative cheapness of the direct mineral-feeding to sheep, and after a preliminary training of some of the sheep the pellet method is easy to manage.

More wonderful still are Brännich's results in Queensland, where, under droughty conditions, a lick was made up to a prescription dictated by the mineral deficiency of the pastures as found by chemical analysis. Each sheep consumed $1\frac{1}{4}$ oz. of a phosphorus-rich salt lick per week, the result being in one large station that the stock carried during the drought period was doubled and the animals were in better condition, as evidenced by decreased mortality and increased percentage of lambing.

The book is well printed, and readers will find it a mine of information. There is a copious bibliography attached to each chapter, and the subject is treated from many angles. After the introduction, (1) the mineral content of pastures, (2) the factors affecting it, (3) the conditions favouring deficiency, and (4) the distribution of deficiency diseases are considered in subsequent chapters. The matter is treated geographically, a chapter being devoted each to Europe, Africa, Australasia, America, and Asia. Horses are considered in a tenth, methods of increasing the mineral food of animals in an eleventh, and the whole is summarized in a twelfth chapter.

B. C. A.

WEATHER RECORDS : APRIL, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THE general character of the weather experienced in April over the North Island and the northern and eastern districts of the South Island may be described as dull and moist with, in most districts, an absence of strong winds. In Westland, Otago, and Southland, on the other hand, it was fine, clear, and pleasant for the greater part of the month.

The total rainfall was below normal over the South Island, except in the north-east portion, and deficiencies were recorded also in the central districts of the North Island. In Marlborough and Nelson Provinces the falls considerably exceeded the average, as also was the case in the northern and eastern districts of the North Island.

Although temperatures were slightly below normal there were no extremes, and frosts were few and usually of only slight intensity. As a result, the growth of pasture was remarkable in all districts for the time of year. The prospects of good supplies of feed in winter are, therefore, everywhere bright. Stock has kept in good condition, but the soft state of the grass, owing to excessive moisture, has prevented the fattening of sheep in some parts of the North Island.

A characteristic of the month has been the frequency with which cyclones have controlled the meteorological situation, and the almost total absence of the westerly type of pressure distribution. Two of the cyclones had noteworthy features and may be briefly described.

The first, which was the one that caused serious floods in Tasmania about the 5th, moved very slowly in a north-east direction across the Tasman, and by the 8th was centred between Norfolk Island and Cape Maria van Diemen, where it remained stationary for several days. On the 11th it had passed east of Cape Maria van Diemen, and then moved gradually southwards off the east coast until the 14th. From the 8th to the latter date much dull, misty weather prevailed. Temperatures were mild until the 13th, after which southerly wind became general and temperatures fell rapidly. Rain was fairly widespread during this period, and many heavy falls occurred in the northern and east-coast districts of the North Island. Some flooding was experienced in the East Cape area.

On the 27th another cyclonic disturbance developed south-west of Norfolk Island. It increased rapidly in extent and intensity as it moved southwards, and by the 28th pressure had fallen to below 29 in. at many places in New Zealand. Special warnings of stormy weather and the likelihood of flood rains were issued on this date. The movement of the storm-centre was slow until the morning of the 29th, when it was situated west of Farewell Spit. Thereafter it moved rapidly across the northern portion of the South Island, and by the evening of the 30th had disappeared to the south-eastwards of the Chatham Islands. General heavy rains were associated with this disturbance, and considerable flooding resulted in the Nelson and Marlborough Districts. In Nelson City the flood was

the worst experienced in the past twenty years. Over the northern half of the North Island strong north-east to northerly gales were experienced. Generally, however, the winds were less severe than might have been expected in view of the fact that the cyclone was one of the most intense experienced in recent years.

—*Edward Kidson, Director of Meteorological Services, Wellington, 6th May, 1929.*

RAINFALL FOR APRIL, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitia	4.87	15	1.50	3.55
2	Russell	6.60	11	1.90	3.59
3	Whangarei	9.99	14	2.91	4.45
4	Auckland	4.62	19	0.99	3.46
5	Hamilton	3.62	11	0.91	3.86
6	Kawhia	2.96	12	0.76	4.64
7	New Plymouth	5.80	16	2.42	4.51
8	Riversdale, Inglewood	5.38	14	2.17	8.39
9	Whangamomona	5.01	12	1.16	6.62
10	Eltham	8.14	11	3.20	5.16
11	Tairua	5.72	14	1.22	6.33
12	Tauranga	4.53	13	1.18	5.08
13	Maraehako Station, Opotiki	6.80	10	2.04	4.57
14	Gisborne	8.73	20	1.76	4.20
15	Taupo	3.40	10	1.27	3.77
16	Napier	3.71	19	1.25	2.92
17	Maraekakaho Stn., Hastings	5.10	21	1.55	3.14
18	Taihape	1.54	11	0.48	3.15
19	Masterton	3.92	18	0.87	3.04
20	Patea	4.02	12	1.23	3.59
21	Wanganui	1.64	5	0.87	3.37
22	Foxton	1.08	5	0.81	2.47
23	Wellington (Karori Reservoir)	7.25	16	3.75	3.80
<i>South Island.</i>					
24	Westport	2.15	10	0.85	6.50
25	Greymouth	2.81	8	1.51	8.37
26	Hokitika	2.89	14	1.26	9.38
27	Ross	2.82	6	1.63	12.55
28	Arthur's Pass	2.08	4	1.23	16.16
29	Okuru, Westland	1.58	5	0.92	13.67
30	Collingwood	8.89	13	2.56	8.07
31	Nelson	9.11	13	4.26	2.93
32	Spring Creek, Blenheim	6.12	11	3.78	1.72
33	Tophouse	6.59	9	1.83	4.22
34	Hanmer Springs	3.87	14	0.85	2.99
35	Highfield, Waiau	4.44	10	1.18	2.66
36	Gore Bay	4.26	10	1.33	1.77
37	Christchurch	1.48	12	0.60	1.97
38	Timaru	1.48	10	0.84	1.51
39	Lambrook Station, Fairlie	1.94	7	0.92	1.95
40	Benmore Station, Clearburn	1.34	8	0.80	2.55
41	Oamaru	1.53	9	1.02	1.78
42	Queenstown	1.31	5	0.90	3.00
43	Clyde	1.08	5	0.68	1.34
44	Dunedin	1.92	11	0.97	2.82
45	Wendon	0.61	5	0.40	3.16
46	Gore	0.74	8	0.35	3.15
47	Invercargill	1.10	10	0.31	4.36
48	Puysegur Point	4.73	12	1.14	7.98
49	Half-moon Bay	1.56	10	0.46	5.29

GOVERNMENT CERTIFICATION OF SEED-POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1928-29.

FOLLOWING is a list of growers who have received provisional certificates in connection with the certification of their seed-potatoes in the past season. Provisional certificates are issued with the object of affording growers some indication of the general standard of their crops, and assisting them in the disposal of their seed. Certificates and certification tags are issued later, provided an officer of the Agriculture Department inspects the graded seed-potatoes, and is satisfied that they are still of the same standard in regard to purity and freedom from disease as was indicated by the field inspection.

Auckland Short-top :—

	Acreage.
L. R. Bell, St. Andrew's, South Canterbury	2
F. Brundell, " Camside," Kaiapoi, North Canterbury	5
W. Eder, R.M.D., Sefton, North Canterbury	11
J. Jellie, Russley Road, Fendalton, Christchurch	3
C. H. Jordan, R.M.D., Kaiapoi, North Canterbury	3
W. E. Martin, R.M.D., Kaiapoi, North Canterbury	15
A. J. Rich, R.M.D., Kaiapoi, North Canterbury	16
J. Rouse, Pareora, Timaru	1
L. Seyb, Washdyke, Timaru	1½
R. Smith, R M D, Kaiapoi, North Canterbury	5
Weeber Bros, Englefield Road, Belfast, North Canterbury	4

Auckland Tall-top :—

J. Bailey, R M D, Kaiapoi, North Canterbury	7
D. Hewitt, Woodend, Kaiapoi, North Canterbury	3
J. D. McMullan, Elmwood, Kaiapoi, North Canterbury	5
L. Seyb, Washdyke, Timaru	1½

Dakota :—

E. S. Barnes, Hinds, Lowcliffe, R M D., Mid-Canterbury	2
James Carr, Mount Hutt, R M D., Rakaia, Mid-Canterbury	1
W. J. Crozier, Mount Hutt, R.M.D., Mitcham, Mid-Canterbury	3
Doak Bros., R.M.D., Rangiora, North Canterbury	12
P. J. Gill, Box 11, Kirwee, North Canterbury	1
George Hurst, Overdale P.O., Rakaia, Mid-Canterbury	6
H. M. Marshall, R M D, Weedon's, North Canterbury	2
W. McLachlan, Hills Road, Leeston, Canterbury	10
W. A. McPhail, Mitcham, Mid-Canterbury	14
E. A. Smith, Lincoln, North Canterbury	15
E. Thompson, R.M.D., Rolleston, North Canterbury	12
C. E. Walker, jun, R.M.D., West Melton, North Canterbury	3

Biesee's Prolific :—

James Carr, Mount Hutt, R.M.D., Rakaia, Mid-Canterbury	2
W. Chappell, R.M.D., Killinchy, Canterbury	7
D. Marshall, R M D, Killinchy, Canterbury	40
I. J. Palmer, Southbridge, Canterbury	5

Arran Chief :—

L. R. Bell, St. Andrew's, South Canterbury	3
Fraser Bros., Southbrook, Rangiora, North Canterbury	7
G. Jones, Vale Royal, Halswell, Christchurch	4
A. Mortland, Templeton, North Canterbury	5
D. Priest, Cave, South Canterbury	1
F. A. Rollinson and Sons, Studholme Junction, South Canterbury	8
E. E. Saunders, Studholme Junction, South Canterbury	7½
F. Saunders, Studholme Junction, South Canterbury	5
J. W. Smith, 103 Ilam Road, Fendalton, Christchurch	3

Up-to-date :—

P. J. Gill, Box 11, Kirwee, North Canterbury	1
F. McNae, R.M.D., Courtenay, North Canterbury	1
J. R. Robinson and Co., 184 Cashel Street, Christchurch	4
C. E. Walker, jun., R.M.D., West Melton, North Canterbury	6
F. Westaway, R.M.D., Courtenay, North Canterbury	8

<i>Epicure</i> :—			Acreage.
D. Marshall, R.M.D., Killinchy, Canterbury	..	..	4
G. McLachlan, Southbridge, Canterbury	..	..	4
E. W. Mote, 98 Grant's Road, Papanui, Christchurch	..	..	1
W. Shellock, Mead Settlement, Rakaia, Mid-Canterbury	..	..	2
L. T. Wright, Annat, North Canterbury	..	..	1
<i>Endurance</i> :—			
R. G. Bishop, R.M.D., Southbridge, Canterbury	..	..	1
W. J. Bishop, R.M.D., Southbridge, Canterbury	..	..	1
R. A. C. Burns, "Ken Burn," Rakaia, Mid-Canterbury	..	..	1½
<i>Early Regent</i> :—			
W. Eder, R.M.D., Sefton, North Canterbury	..	..	20
W. S. Kelly, 502 Lincoln Road, Halswell, Christchurch	..	..	3
<i>Majestic</i> :—			
A. J. Clark, Box 34, Rangiora, North Canterbury	..	..	2
W. J. Tozer, Davey Street, Temuka, South Canterbury	..	..	3½
<i>Great Scott</i> :—			
E. W. Mote, 98 Grant's Road, Papanui, Christchurch	..	..	1
A. Spillane, John Street, Temuka, South Canterbury	..	..	1
<i>Golden Wonder</i> :—			
G. E. Benny, R.M.D., Southbridge, Canterbury	..	..	1
S. Kokay, Tuatapere, Southland	..	..	2½
<i>Field-Marshal</i> :—			
L. T. Wright, Annat, North Canterbury	..	..	7
<i>Brownell's Beauty</i> :—			
F. McNae, R.M.D., Courtenay, North Canterbury	..	..	1
<i>Northern Star (Gamekeeper)</i> :—			
Hayman Bros., Willowbridge, South Canterbury	..	..	12
<i>King Edward</i> :—			
R. Knibbs, McNab, via Gore, Southland	..	..	1½

—Fields Division.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 21st March to 2nd May, 1929, include the following of agricultural interest :—

No. 62000 : Milking-machine ; J. G. Lamb, Melbourne, Vic. No. 60173 : Portable bail for dehorning cattle, S. Armstrong, Tuhikaramea, Frankton Junction. No. 60681 : Self-clearing harrow ; D. A. Dunn, Gore. No. 62068 : Feed-bin for milking-shed ; A. M. Bisley, Hamilton. No. 62116 : Milk-can ; W. Harvey, Auckland. No. 59566 : Indicator of yield of milk from cows ; F. Marsden and A. J. C. Woodward, Wellington. No. 60631 : Animal ointment ; Violet H. Lee, Auckland. No. 61843 : Cream ; J. E. Nyrop, Copenhagen, Denmark. No. 62017 : Sterilizing double cream ; S. Grasse, Glasgow, Scotland. No. 62175 : Noxious-weed destroyer ; W. H. Clarkson, Otahuhu. No. 62340 : Planting-machine ; I. Pomieraniec, London, England. No. 57999 : Milking-machine pulsator ; H. H. Sutton, Waihi. No. 62344 : Egg-case filler pad ; R. W. Burrows, Sonoma, U.S.A.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

The Ragwort-moth.—At last month's meeting of the Council of Scientific Research the Chairman stated : " Good reports are to hand regarding the damage done to ragwort by the larvæ of *Tyria jacobææ*. It is hoped that there will be a good emergence of moths in the fields next year, and that large supplies of eggs will be available for distribution throughout the ragwort areas. Apparently a big factor in the ultimate success of ragwort destruction with this moth will be the mass distribution of large supplies as early as is possible in the next season, before parasites have an opportunity of establishing themselves on the *Tyria* itself."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF GREASY HEEL ON HORSE.

C.O.B., Tauranga :—

Would you let me know if there is a cure for greasy heel on a horse? I have a horse badly affected. I bathe the part in salt water every day. The fetlock is swollen, and has large grape-like lumps of a greyish-blue colour. Could they be burnt off?

The Live-stock Division :—

The cure of an old-standing case of grease, when "grapes" have formed, is not an easy matter. First of all, the parts should be thoroughly cleansed with hot water and soap, after which the hair on the edges of any cracks should be clipped off. A wet bran poultice to which has been added some disinfectant should be packed down into a bag fitted round the coronet and reaching up over the fetlock, where it should be tied. This poultice should be kept wet with hot water at intervals for one day. After the parts have become softened and properly cleaned up, water should not be applied again unless necessary to clear away dirt or to soften any scabs which may have formed. When swabbed dry, iodine ointment should be applied to any cracks or raw surfaces for a few days until these lesions look nice and healthy. After this a drying-agent should be employed, and a good one to use will be zinc-oxide ointment, which should be applied frequently with the aid of wads of tow or cotton-wool, which are kept in position by bandages. The "grapes" may be burnt off with a blacksmith's fire-shovel which has been sharpened, but this should not be attempted if the bases of the "grapes" are large in extent and big wounds likely to result. It would be advisable to burn off only one or two at first. A good caustic agent, such as equal parts of powdered bluestone and lard, applied to the "grapes" will probably be the best treatment for reducing them. This dressing may be repeated every day or two until the growths are sufficiently reduced. All precautions should be taken to keep the affected parts dry and clean.

MIXING OF SUPERPHOSPHATE AND BASIC SLAG.

"BUSH FARMER," Otorohanga :—

I should be obliged for any information concerning the mixing of superphosphate and basic slag for broadcasting on hill country. Has the heating process which takes place after these manures have been mixed and left awhile any detrimental effect on either?

The Fields Division :—

The effect of mixing these fertilizers together is that the water-soluble phosphate in super is reverted to a form insoluble in water but quickly available to plants. The mixture is quite good for top-dressing hill country, but the fertilizers must be mixed in the paddock and applied immediately after mixing. If the mixture is left it sets hard like concrete.

PASTURE TOP-DRESSINGS.

F. J. CARTER, Rangataua :—

We have been doing a large amount of top-dressing with lime and superphosphate mixed in about equal quantities. We use about 2 cwt. per acre, and find we are getting good results. The trouble is that the cost of mixing and handling seems excessive. Would as good results be obtained by the use of basic

superphosphate? How does the amount of fertilizing ingredients in basic super compare with that in superphosphate? Our country is light loam, situated at Karioi.

The Fields Division :—

You should get better results from 2 cwt. of basic super than 2 cwt. half lime half super. The first cost will be more, but the results should give a greater return for the expenditure. Basic super is usually made up of twelve parts super, four parts Nauru or other rock phosphate, and four parts carbonate of lime. We would suggest (1) that you apply about 5 cwt. of lime per acre in one dressing, and then apply super annually for three or four years; then repeat the dressing of lime; (2) that you use half super and half Nauru, or alternatively (3) basic super. Present results indicate that the half super half Nauru mixture will be the most economic fertilizer for your land.

RAISING WALNUT-TREES.

“WALNUT,” Okaiawa :—

Would you please advise me how to grow walnuts from nuts. Can they be sown in tins or boxes and planted out when ready? When is the best time to sow, and how long do they take to come up? Should glass be laid over the top of the box?

The Horticulture Division :—

To grow walnut-trees from seed, selected nuts should now be mixed with sand or friable soil in a cool place, and allowed to remain there until the spring. They should be collected and planted out in a piece of good land during the month of August, 12 in. to 18 in. apart and 2½ ft. between the rows, covering the nuts with 2 in. to 3 in. of soil. In the following autumn after the leaves have fallen the young trees may be lifted and planted out. At this operation the extremity of the tap-root should be cut off to induce a growth of fibrous roots. As an alternative, the nuts may be sown where the trees are to remain, but in that case, while they will make larger trees, they will be much slower in bearing a crop.

FERTILIZER IMPORTATIONS: MARCH QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 31st March, 1929 :—

Sulphate of ammonia : United Kingdom, 230 tons; Australia, 10 tons; United States, 228 tons. *Calcium cyanamide* : Norway, 2 tons. *Nitrate of soda* : Netherlands, 50 tons; Chile, 885 tons. *Basic slag* : United Kingdom, 3,550 tons; Belgium, 30,845 tons; France, 35 tons. *Bonedust* : India, 75 tons. *Rock phosphate and guano* : United Kingdom, 10 tons; Seychelle Islands, 4,072 tons; Nauru, 23,079 tons; Makatea, 8,330 tons. *Superphosphate* : Belgium, 50 tons. *Phosphates (other)* : United Kingdom, 150 tons; Belgium, 10,768 tons; Morocco, 7,609 tons. *Kainit* : France, 260 tons; Germany, 57 tons. *Sulphate of potash* : France, 187 tons; Germany, 96 tons. *Potash manures (other)* : Belgium, 25 tons; France, 731 tons; Germany, 785 tons. *Sulphate of iron* : Australia, 5 tons. *Manures (other)* : United Kingdom, 6 tons; Germany, 53 tons; Norway, 1 ton.

Rearing of Young Stock.—In the care and management of young stock nothing is more essential than a plentiful and nourishing food-supply. A maintenance ration can be given to an adult animal in a time of food scarcity without detrimental effect, but not so in the case of young stock. For the latter a ration is necessary containing a liberal percentage of proteins (flesh-formers). As the adult stage is reached less protein and more carbohydrates (starches) can be given.—*Live-stock Division.*

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CERTIFICATION OF SEED POTATOES.

REVIEW OF OPERATIONS, SEASON 1928-29.

J. W. HADFIELD, H.D.A., Agronomist, and J. H. CLARIDGE, B.Agr., Assistant in Agronomy, Christchurch

BEFORE proceeding with the present review it may not be out of place to outline the salient features of the seed-potato-certification system established by the Department of Agriculture in 1927.

The objective is to supply information that will enable merchants and growers to obtain seed which is true to name, reasonably free from tuber-borne diseases, and of approved cropping-power. Growers are invited to submit their crops for inspection, and to forward with each application one hundred setts from the seed they intend to plant. These samples are then grown by the Department under uniform conditions, in such a manner that it is possible to compare the growth of each line with that of all other lines of the same variety, and to harvest and weigh the product of each so as to determine the relative cropping-power. About January the grower is visited and the first field inspection undertaken. The second inspection follows when the shaws are dying down, and a final tuber-inspection is made when the grower has graded and bagged his seed ready for sale. If a crop passes the necessary standards the grower is issued with a certificate, and sufficient certification tags to enable him to attach one tag to each sack of certified seed he has for sale.

During the season under review certification operated over the South Island only, but next season it is hoped that operations will be extended to embrace the whole Dominion.

CROPPING-POWER.

This second season in which certification has been in operation has brought forward additional proof of the practical importance of what we are terming "cropping-power." It is very obvious that virus disease is the chief cause of the unproductive crop, but the technique of determining its incidence, and more especially the degree of infection, or what might be termed the degree of degeneracy in a particular line, is far from perfect. Potato crops are grown on a wide range of soil types which vary considerably in fertility, and it becomes impos-

to determine relative degeneracy from a field inspection. The certification trial, in which each line is grown under uniform conditions in replicated plots, affords a means of comparison in the early stages by inspection of the foliage, and later, by digging the plots and weighing the yields, an equally valuable means of determining the cropping-power. This trial is the most reliable guide in deciding whether the line should be accepted, and would in itself be almost sufficient were it not for minor diseases such as eelworm and powdery scab, and the necessity for identifying the field crop so as to be assured that its seed, and no other, is tagged as certified.

In Table 1 are listed the yields of the various lines in the certification trials. The column "Cropping-power" requires some explanation. In a trial where "seed" and "table" tubers are both weighed it becomes difficult to compare a yield showing "seed and table" with another yield of "seed and table" unless the two are added together to give a "total yield."

The disadvantage of using total yield lies in the fact that one would thereby make "seed" of equal value with "table," and from a cropping point of view this seems undesirable. On the other hand, "seed" is of value in cropping-power as an indication of the possibilities of the line on better land, and after several years' experience it has been judged to be equal to about one-half the value of "table." Therefore to determine cropping-power the yield of table plus half the seed is taken into account.

RANGE OF YIELD IN DIFFERENT VARIETIES.

In Fig. 1 an attempt has been made to graphically represent the range of variation in lines of several different varieties.

On the extreme left the variety Epicure shows a great range, and it is generally realized that a great deal of the seed offered on the market is quite worthless and incapable of producing profitable yields. The Bresec's Prolific lines, on the other hand, show little variation (both this season and last), which is explained by the fact that one grower has for many years been the main source of supply of seed of this variety. The Dakotas show a fair range of yields, but there are not so many very bad crops entered this season as was the case last year. It is interesting to note that the grower who topped the list in Dakota and Up-to-date last season retains this unique position for a second year.

Aucklander Short-top (N.Z. Sutton's Supreme) does not show a wide range, with the exception of two or three lines badly infected with leaf-roll. It must be remembered that it is not so many years since the variety was introduced, and during most of this time it has been confined to the Kaiapoi and Rangiora district.

Up-to-date shows a wide range of variation, due mainly to leaf-roll and wilt disease. The highest-yielding strain has maintained its position, and even improved its relative superiority since last season. One would have expected a greater range in the Arran Chief variety than has been obtained. Many of the lines entered, however, contained so many Northern Stars that any computation of yield would have been misleading, and these have therefore been left out.

Table I.—Showing Yield of each Line entered in connection with Certification of Seed Potatoes, Season 1928-29.

The lines were grown under uniform conditions, and each yield is the average of five replications. (See also Fig. 1.)

Variety and Row Number.	Yield in Tons per Acre.			Variety and Row Number.	Yield in Tons per Acre.		
	Table.	Seed.	Crop-ping-power.		Table.	Seed.	Crop-ping-power.
<i>Aucklanders Short-top</i> :—				<i>Dakota</i> —contd.			
46 ..	6.4	6.3	9.55	91 ..	6.7	3.9	8.6
29 ..	6.4	5.0	8.9	60 ..	6.1	4.5	8.35
15 ..	6.5	4.4	8.7	79 ..	6.1	4.3	8.25
21 ..	6.5	4.4	8.7	82 ..	6.0	4.4	8.2
58 ..	6.2	4.9	8.65	68 ..	5.8	4.7	8.15
17 ..	6.0	5.0	8.5	62 ..	5.4	5.4	8.1
18 ..	6.2	4.6	8.5	77 ..	5.4	5.1	7.95
33 ..	6.1	4.7	8.45	65 ..	5.9	4.1	7.9
24 ..	6.3	4.1	8.35	66 ..	5.3	5.0	7.8
40 ..	5.8	4.8	8.2	72 ..	5.2	4.7	7.55
32 ..	5.8	4.6	8.1	64 ..	5.0	4.7	7.35
22 ..	4.9	6.3	8.05	89 ..	5.7	2.9	7.15
27 ..	5.2	5.6	8.0	80 ..	4.7	4.8	7.1
36 ..	5.7	4.5	7.95	73 ..	4.9	4.1	7.0
23 ..	5.9	4.1	7.95	84 ..	4.7	4.6	7.0
19 ..	5.9	4.0	7.9	81 ..	4.5	4.7	6.85
34 ..	4.5	6.5	7.75	76 ..	4.5	4.5	6.75
28 ..	5.3	4.5	7.55	69 ..	4.3	4.6	6.6
42 ..	5.0	5.0	7.5	63 ..	4.5	3.9	6.45
30 ..	4.5	5.7	7.4	92 ..	4.5	3.8	6.4
38 ..	5.0	4.7	7.4	86 ..	4.4	3.9	6.35
45 ..	5.0	4.7	7.4	67 ..	4.2	4.2	6.3
25 ..	4.8	5.0	7.35	74 ..	3.7	4.3	5.85
31 ..	5.0	4.6	7.35	90 ..	4.4	2.5	5.65
48 ..	5.3	4.0	7.3	61 ..	3.6	3.5	5.35
26 ..	4.5	5.5	7.25	71 ..	2.1	3.2	3.7
35 ..	5.0	4.2	7.1	Average ..	5.4	4.4	7.6
43 ..	4.8	4.6	7.1	<i>Golden Wonder</i> :—			
39 ..	4.5	4.4	6.7	176 ..	4.8	4.9	7.25
44 ..	4.5	4.4	6.7	177 ..	3.6	4.0	5.6
20 ..	4.7	3.7	6.55	Average ..	4.2	4.5	6.45
37 ..	4.1	3.8	6.0	<i>Up-to-date</i> :—			
47 ..	3.0	2.5	4.25	125 ..	8.7	6.3	11.85
Average ..	5.4	4.7	7.75	126 ..	5.6	5.5	8.35
<i>Early Regent</i> :—				132 ..	6.2	3.6	8.0
168 ..	4.5	3.3	6.15	134 ..	5.2	5.6	8.0
166 ..	3.6	3.2	5.2	128 ..	6.3	3.0	7.8
Average ..	4.1	3.3	5.75	133 ..	6.0	3.4	7.7
<i>Dakota</i> :—				124 ..	5.6	3.6	7.4
78 ..	8.2	6.6	11.5	135 ..	5.2	3.5	6.95
123 ..	7.4	5.7	10.25	136 ..	4.9	3.8	6.8
70 ..	7.6	4.2	9.7	137 ..	4.4	4.0	6.4
87 ..	7.4	4.7	9.7	127 ..	3.6	4.8	6.0
88 ..	7.2	4.2	9.3	130 ..	3.9	2.4	5.1
75 ..	6.5	4.6	8.8	129 ..	3.0	3.0	4.5
83 ..	6.4	4.5	8.65	131 ..	2.9	2.5	4.15
85 ..	6.7	3.9	8.6	Average ..	5.1	3.9	7.05

Table 1—continued.

Variety and Row Number.	Yield in Tons per Acre.			Variety and Row Number.	Yield in Tons per Acre.		
	Table	Seed.	Crop- ping- power.		Table.	Seed.	Crop- ping- power.
<i>Auckland Tall-</i> <i>top :—</i>				<i>Epicure— contd.</i>			
57 ..	8.4	5.8	11.3	144 ..	4.2	2.7	5.55
55 ..	8.6	3.8	10.5	150 ..	4.3	2.2	5.4
102* ..	8.3	4.2	10.4	147 ..	3.3	2.3	4.45
51 ..	7.8	4.5	10.05	140 ..	2.4	1.7	3.25
59 ..	8.1	3.8	10.0	142 ..	2.3	1.7	3.15
50 ..	6.6	5.4	9.3	149 ..	2.4	1.4	3.1
54 ..	7.0	3.7	8.85	145 ..	2.0	2.0	3.0
56 ..	6.6	4.2	8.7	141 ..	1.8	1.5	3.15
Average ..	7.7	4.4	9.9	Average ..	3.7	2.3	4.85
<i>Bresee's Pro-</i> <i>lific :—</i>				<i>Majestic .—</i>			
98 ..	6.0	4.2	8.1	156 ..	9.0	4.2	11.1
93 ..	5.7	4.6	8.0	152 ..	7.6	4.0	9.6
99 ..	6.1	3.7	7.95	151 ..	5.6	4.8	8.0
95 ..	5.2	4.2	7.3	154 ..	5.5	3.3	7.15
94 ..	4.9	4.6	7.2	153 ..	3.1	2.9	4.55
192† ..	5.4	3.4	7.1	Average ..	6.2	3.8	8.10
97 ..	5.2	3.6	7.0	<i>Endurance :—</i>			
193† ..	4.8	4.2	6.9	173 ..	10.5	3.1	12.05
96 ..	4.8	3.6	6.6	174 ..	5.7	2.8	7.1
Average ..	5.3	4.0	7.3	175 ..	5.7	2.7	7.05
<i>King Edward :—</i>				172 ..	3.8	2.0	4.8
171 ..	6.1	5.1	8.65	Average ..	6.4	2.7	7.75
170 ..	5.4	4.2	7.5	<i>Sharpe's Ex-</i> <i>press :—</i>			
169 ..	3.6	2.8	5.0	180 ..	4.2	3.9	6.15
Average ..	5.0	4.0	7.0	181 ..	3.2	3.0	4.7
<i>Arran Chief :—</i>				Average ..	3.7	3.5	5.45
120 ..	7.4	4.5	9.65	<i>Gold Coin .—</i>			
107 ..	6.8	4.4	9.0	178 ..	7.0	3.1	8.55
105 ..	6.7	4.5	8.95	179 ..	4.3	3.0	5.8
108 ..	6.7	4.5	8.95	Average ..	5.7	3.1	7.25
102 ..	6.4	4.5	8.65	<i>Great Scott :—</i>			
103 ..	6.4	4.3	8.55	183 ..	6.5	4.1	8.55
110 ..	6.4	4.0	8.4	182 ..	5.8	4.7	8.15
101 ..	6.4	3.5	8.15	Average ..	6.2	4.4	8.4
116 ..	6.0	4.0	8.0	<i>Kerr's Pink :—</i>			
109 ..	5.6	4.6	7.9	184 ..	3.4	3.1	4.95
104 ..	5.3	3.7	7.15	<i>Robin Adair :—</i>			
111 ..	5.3	3.2	6.9	185 ..	7.0	4.7	9.35
113 ..	4.0	4.6	6.3	<i>New Era :—</i>			
Average ..	6.1	4.2	8.2	186 ..	4.6	3.5	6.35
<i>Epicure :—</i>				<i>Early Rose :—</i>			
148 ..	5.9	2.7	7.25	187 ..	2.6	3.3	4.25
146 ..	5.6	3.2	7.2				
139 ..	4.4	3.3	6.05				
143 ..	4.6	2.8	6.0				

* Grown some distance away from the other lines, but has the same origin as Nos. 55 and 59.

† Sent in as "Early Puritan."

Table 1—continued.

Variety and Row Number.	Yield in Tons per Acre.			Variety and Row Number.	Yield in Tons per Acre.		
	Table.	Seed.	Crop-ping-power.		Table.	Seed.	Crop-ping-power.
<i>Northern Star</i> :— 188 ..	5.7	5.1	8.25	<i>Brownell's Beauty</i> :— 190 ..	9.9	1.6	10.7
<i>Witchill</i> :— 189 ..	0.6	2.0	1.6	<i>Field Marshal</i> :— 138 ..	6.3	7.7	10.15

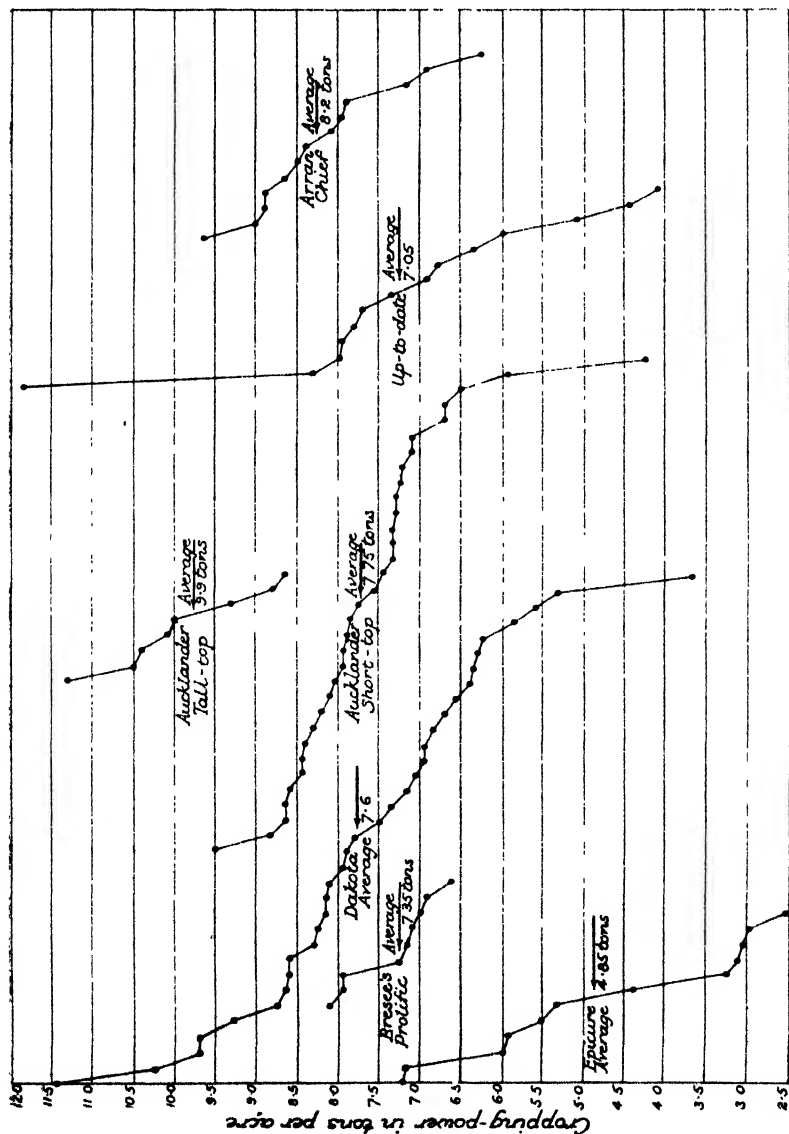


FIG. 1 GRAPHICAL REPRESENTATION OF RANGE IN CROPPING-POWER SHOWN BY LINES OF THE MORE IMPORTANT POTATO VARIETIES UNDER TRIAL.

It is interesting to note that, with the exception of Epicure and other "first-earlies," the average yields of the different varieties are fairly constant, and it is very evident that there may be greater variation within a variety than between one variety and another. Auckland Tall-top is a notable exception, and is the heaviest-yielding variety under trial. These lines were grown alongside the Auckland Short-tops, yet the average of the Tall-top is above the highest-yielding line of the Short-tops.



FIG. 2. GENERAL VIEW OF LINES OF UP-TO-DATE UNDER CERTIFICATION TRIAL AT ASHBURTON EXPERIMENTAL FARM, SHOWING VARIATION IN VIGOUR AND CROPPING-POWER.



FIG. 3. PRODUCE OF THE TWO HIGHEST- AND TWO LOWEST-YIELDING LINES OF DAKOTA UNDER CERTIFICATION TRIAL.

INCIDENCE OF VIRUS DISEASE.

Any attempt to draw conclusions from counts made during field inspections is liable to be misleading, and in Table 2 is shown the incidence of virus in the certification trials, where the lines are grown under uniform conditions and the counts can be made about the same time. Since it would be unfair to draw conclusions from varieties represented by only one or two lines, these have been left out.

It is important to explain that in these inspections a plant is recorded as diseased only when its vitality has been reduced to such an extent as to render it definitely subnormal. Thus in each case there is evidence that the vitality and yield have suffered, and that this is directly attributable to virus, in particular to that virus which is recorded against it.

It is not possible to describe at all clearly the degree of degeneracy at which a count would be recorded, but after some practice those concerned in making the counts can establish a satisfactorily uniform standard. Such a system may be open to criticism, but the objective has been to determine the extent of the damage done by virus in each line, and if one were to take the total incidence there would result such valueless figures as "Up-to-date, 100 per cent. leaf-roll," or "Iron Duke, 100 per cent. mosaic," both of which would be literally true.

Table 2.—Incidence of Virus Disease in Trial Plots at Ashburton Experimental Farm, Season 1928-29.

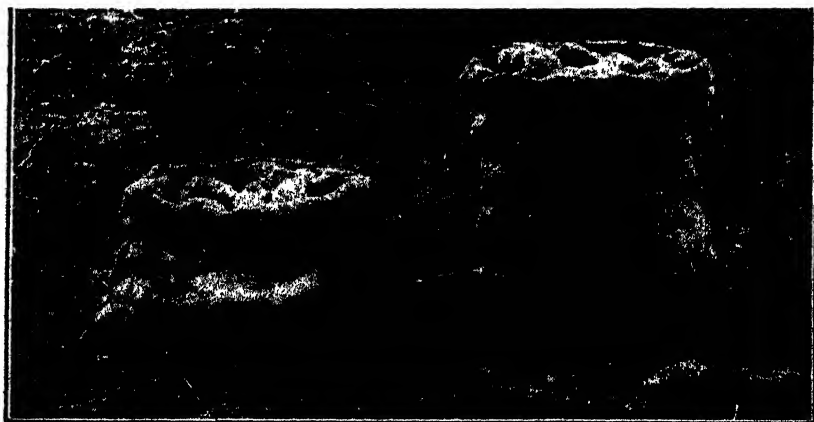
Lines examined. (100 Plants in each Line.)	Leaf-roll.		Mosaic.		Stipple-streak.		Crinkle.		Total.	
	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.
<i>Auckland</i> <i>Short-top</i> :—										
32 ..	13.3	0-59	0.2	0-2	1 plant		1.5	0-8	15.0	1-61
<i>Auckland</i> <i>Tall-top</i> :—										
8 ..	7.1	2-16	1 plant		..	..	0.7	0-3	8.0	2-17
<i>Dakota</i> :—										
34 ..	16.5	0-79	8.0	2-16	..	..	0.8	0-6	25.2	4-79
<i>Bresee's Prolific</i> :—										
8 ..	3.5	1-10	10.9	6-16	2.6	0-14	0.6	0-2	17.6	9-25
<i>Arran Chief</i> :—										
14 ..	2.4	0-14	22.7	13-52	1 plant		2.1	0-9	20.3	19-62
<i>Up-to-date</i> :—										
15 ..	40.3	2-63	1.9	0-6	3.2	0-17	1 plant		45.4	5-77
<i>Epicure</i> :—										
9 ..	4.1	1-7	22.8	0-45	..	..	2 plants		27.1	5-48
<i>Majestic</i> :—										
5 ..	35.0	13-74	2.6	1-5	2.2	0-11	..	..	39.8	15-75
<i>Iron Duke</i> :—										
4 ..	24.0	4-50	*8.0	*5-12	1 plant		..	..	32.2	16-56
<i>Endurance</i> :—										
4 ..	6.0	2-12	23.5	6-33	1.0	0-4	8.0	4-18	38.5	13-56
<i>King Edward</i> :—										
3 ..	10.0	1-27	2 plants		1 plant		18.7	0-55	29.7	3-59

* Only the most severe mosaic recorded.



FIG. 4. CROPS OF AUCKLANDER SHORT-TOP AT ASHBURTON EXPERIMENTAL FARM.

The line on left was seriously affected with leaf-roll, this, being responsible for the lower yield shown on left of Fig. 5.



4'25 tons per acre.

9'55 tons.

FIG. 5. YIELDS OF THE TWO LINES OF AUCKLANDER SHORT-TOP SHOWN IN FIG. 4 ABOVE.

When a plant is affected by more than one virus the most obvious one is recorded. A good deal of difficulty has been experienced in differentiating between "crinkle" and "advanced mosaic," but in a general way the figures are interesting, and indicate that leaf-roll is the most serious virus disease, and is most in evidence in Aucklander Short-top, Dakota, Up-to-date, Majestic, and Iron Duke. Mosaic is by no means so serious a factor except in Arran Chief. The high percentage of mosaic recorded in the Epicure lines may be somewhat misleading, as much of it was extremely difficult to identify. Although for two years we have been unable to find a single Iron Duke free from mosaic (only the most advanced cases are recorded in these counts), yet this disease is not the main cause of the many failures of this variety. Leaf-roll is the primary cause, and while the variety is tolerant to mosaic it succumbs at once to leaf-roll.

These counts were made in January, and stipple-streak is more in evidence later in the season, so that the figures recorded are not indicative of the damage caused by this virus.

REASONS FOR REJECTION.

It would be easy to tabulate from our field-books all the reasons given for rejecting crops, but it would be extremely misleading. A crop may be subject to rejection for several reasons. If it contains a high percentage of foreign varieties it is rejected and no other records are taken. The field-book records are intended to be of practical value in deciding upon acceptances and rejections, and not for the purpose at present in view. Table 3 shows reasons for rejection, covering all varieties, and should be a fairly close approximation. Of the 167 crops eligible for inspection, the numbers (and percentages) given in the table were below the required standard for the reasons indicated. Some crops are recorded as being rejected for more than one cause. Sixty-six crops, or 40 per cent., received provisional certificates.

Table 3.—Summary of Rejections.

Number of Crops.	Rejection Percentage.	Reasons for Rejection.
51	30.5	Insufficient cropping-power due to virus infection.
39	23.4	Above 2 per cent. of foreign varieties.
12	7.2	Powdery scab.
9	5.4	Eelworm.
5	3.0	Late blight.
2	1.2	Wilt diseases.

AREAS PROVISIONALLY PASSED.

Provisional certificates are issued after the second field inspection, and are in effect a statement that the grower will receive a certificate provided the final tuber-inspection reveals the same standard as has been indicated by the preceding field inspection.

From the list given in Table 4 it will be seen that while the number of growers and the number of varieties have increased this season there

Table 4.—Crops of each Variety provisionally certified, 1927–28 and 1928–29.

Variety.	Number of Crops.		Area in Acres.	
	1927–28.	1928–29.	1927–28.	1928–29.
Auckland Short-top	7	11	75	67
Auckland Tall-top	5	4	30	17
Dakota	11	12	121	81
Bresee's Prolific	10	4	106	54
Arran Chief	4	9	36	54
Up-to-date	3	5	13	20
Epicure	5	6	13	15
Endurance	1	3	1	4
Early Regent	1	2	35	23
Majestic	Nil	2	Nil	6
Great Scott	Nil	2	Nil	2
Golden Wonder	Nil	2	Nil	4
Field Marshal	Nil	1	Nil	7
Brownell's Beauty	Nil	1	Nil	1
Northern Star (Gamekeeper)	1	1	35	12
King Edward	Nil	1	Nil	2
Robin Adair	2	Nil	6	Nil
Totals	50	66	471	369
Average areas .. ..	..	..	9.4	5.5

is a considerable decrease in the total acreage. The average area per crop is little more than half of what it was last season, and this is a definite indication that growers are confining their attention to smaller areas with a view to bringing these up to a higher standard.

Sixty-five provisional certificates have been issued to growers. A list of these, together with the respective acreages, was published in last month's *Journal* (page 363), to which those interested are referred. The present opportunity is taken to make some slight amendments: Under "Up-to-date" the name J. R. Robinson and Co. should be I. Robinson and Co.; under "Arran Chief" the area grown by F. A. Rollinson and Sons should be 18 acres; under "Epicure" add A. Spillane, Temuka, 3 acres.

SALT CONTENT OF BUTTER.

THE percentage of salt suitable for most markets is 1.8 up to but not exceeding 2.0, and this is our general recommendation to buttermakers. Special orders occasionally come to hand for a slightly higher percentage, and factories filling these orders usually notify the Grader to that effect. The tendency on the part of some factory-managers to increase the salt content merely to increase the overrun is a short-sighted policy and should be discouraged. Where the salt content is heavy and the water content high it is easy for butter to contain less than the legal content of 80 per cent. of fat. In such cases action can be taken against the makers, and the rule is to deal with such butter in the same way as butter with an excess of water is dealt with.—*Dairy Division.*

CONTAGIOUS ABORTION IN DAIRY CATTLE.

PRACTICAL POINTS FOR FARMERS.

Live-stock Division.

CONTAGIOUS abortion in dairy cows, resulting as it does in the loss of calves and milk-supply, is a disease that requires the most careful attention by our farmers. It is only by studying the nature of the disease that proper and effective measures can be taken to control and prevent the spread throughout a herd. There is also the serious aspect of sterility and loss of breeding as a sequel to the disease. Probably contagious abortion is a more common factor than any other in causing permanent sterility in cows, as distinct from the condition of temporary sterility which so frequently occurs in this country.

The disease is a very insidious one, and may be present in a herd for some weeks or months before an actual abortion takes place, which act is the only outward sign for the farmer that something is amiss. The disease is due to a specific organism — Bang's bacillus — which invades the womb of the pregnant animal, setting up a chronic inflammation between the membranes and the wall of the womb. Later the blood-supply of the developing foetus is cut off by this inflammation, the foetus acts as a foreign body, and the stimulus is given for the act of abortion.

All pregnant bovines are liable to infection, but probably first-calving heifers are more susceptible, as they have not previously had an opportunity of developing any immunity to the organism. Once an animal has aborted a certain degree of immunity is developed, but this may not be sufficient to enable the animal to remain pregnant throughout the full period of a second pregnancy. Invariably, however, the infected animal will carry her third calf the full period. At each and all of these births the cow is a possible source of contamination of pastures through the discharges which come away at parturition.

At the time of abortion there is generally a profuse discharge of a yellowish chocolate-coloured appearance, which is most dangerous from an infective viewpoint. As infection occurs in the majority of cases through ingestion of food or water contaminated by the discharge from a previous case of the disease, the necessity at once becomes apparent of detecting a recently aborted cow, isolating such an animal in a paddock by herself, effectively dealing with all the discharges by burning, burying, or spreading them over with freshly burnt lime, keeping the animal isolated from the herd until all discharge has ceased, washing the vaginal passage and the womb itself (when possible) at regular intervals while the discharge lasts, washing the external genitals and tail with weak antiseptic solutions at regular intervals, and taking all other known precautions to prevent contamination of the remainder of the herd.

It is true that occasionally abortion of a sporadic nature, and not due to the specified organism, does occur. Such cases usually result from an injury, a fall on rough country, excessive dogging and trucking, and dietetic causes such as frosted roots or fermenting foodstuffs likely

to cause severe indigestion and "bloating." It is much safer in dealing with abortion disease to treat every case as contagious and adopt preventive measures until the cause is proved otherwise.

For the detection of the disease the farmer himself, or a reliable deputy, should carefully examine his herd twice daily at each milking-time. In this way any animal suspected of early or premature calving, as shown by the appearance of the external genitals, can be isolated from the herd. A small isolation paddock close to the homestead is essential for this purpose. The paddock can be used for calves if not otherwise required.

When abortion has taken place there is a tendency for retention of the foetal membranes. Such retention is likely to cause a chronic inflammation of the womb through the invasion of secondary organisms, which is undoubtedly a common cause of sterility afterwards. This being so, certain measures, such as the careful removal of the membranes by hand, together with frequent flooding and washing out of the womb with weak antiseptics at regular intervals, are recommended.

As curative measures are not satisfactory and vaccination against the disease is also unsatisfactory in bringing about immunity against attack, farmers are advised to use all their powers of observation in the early detection of the disease, and to take every possible precaution to prevent its entry and spread in a herd.

The method of control of the disease which, in the present state of world knowledge, offers more hope of success than any other is the building-up of an abortion-free herd in the case of an already badly infected herd, and in the case of a slightly infected herd the elimination of all reactors to the blood agglutination test. With this disease more than any other the farmer should provide his young stock by rearing his own heifers, thus preventing the introduction of the disease from outside sources. When getting rid of animals which have aborted the works should be availed of, as if these animals are passed through the saleyards an unsuspecting buyer may thus introduce the disease to his herd.

The bull may transmit the disease from an infected animal to a clean animal by actual physical contact or through service. The bull may even harbour the organism in his genital organs. However, by far the commonest method of infection in cows is by ingestion of contaminated food or water.

In diagnosing the extent of the disease in any herd a physical examination of the animals is not of much assistance. The laboratory test known as the agglutination test is quite dependable; to enable this to be carried out samples of blood taken under conditions which prevent contamination are necessary. The Veterinary Laboratory at Wallaceville tests hundreds of samples of blood for farmers annually, and gives them the true extent of the disease in their herds if present.

After abortion has taken place it frequently happens that such animals appear in season very soon afterwards. On no account should these animals be allowed to the bull until at least six weeks or two months after all discharge has ceased. To effect this it is absolutely essential that the bull should be kept under control and not allowed to mix with the herd.



WALLACEVILLE VETERINARY LABORATORY.

CONTROL POINTS SUMMARIZED.

Essential points in the control of contagious abortion may be summarized as follows :—

- (1) Do not allow the bull to mix with the herd. Take the cows to him for service when considered clean.
- (2) Wash out the sheath of the bull after service of a suspected unclean cow.
- (3) Isolate a cow immediately abortion has taken place, or preferably before the act has taken place, if possible.
- (4) Destroy the fœtus and all discharges afterwards by burning or by quicklime.
- (5) Keep the cow in isolation until all discharge has ceased; and do not allow service until at least six weeks after all discharge has ceased.
- (6) Give frequent and regular douching and washing of the womb and external genitals immediately after abortion, and while the discharge is coming away.
- (7) The solutions for douching recommended are weak solutions of Condyl's crystals in water, or normal saline solution (1 oz. salt to 1 gallon water).
- (8) Rear your own heifer calves and become independent of outside buying, hence running less risk of introducing the disease into a clean herd.
- (9) When disposing of aborting animals send them to the works, and do not risk contaminating saleyards and clean cattle.
- (10) When buying animals for introduction into a clean herd buy subject to their passing the agglutination test.
- (11) Do not allow bulls to wander at large; the scrub bull is always a menace in this respect.

In order to effectively deal with these recommendations extra labour on many farms would appear to be necessary. At the same time the extra returns from an abortion-free herd, and a reduction of the

incidence of the disease in the country as a whole, with the consequent increased annual output of milk and milk-products, would compensate manyfold for the extra labour involved. There is probably no disease in which careful management and regular attention by the farmer is better repaid.

THE BLOOD AGGLUTINATION TEST.

Mr. C. S. M. Hopkirk, Officer in Charge of the Veterinary Laboratory, Wallaceville, contributes the following notes :—

For some time past the field officers of the Live-stock Division of the Agriculture Department have been advising farmers to make use of the special blood-test known as the agglutination or the serological test, in order to determine whether cows in their herds are harbouring the germs of contagious abortion, and to separate any affected animals from the clean cows and keep them separate.

Lately in the United States a committee consisting of men of very great experience has made an inquiry into contagious abortion, and published a report which is worth repeating as the last word on the subject. Their main conclusions are published in the *Journal of the American Medical Association*, Vol. 74, March, 1929. In these they call attention to the following facts :—

- (1) Contagious abortion is now a controllable disease.
- (2) The serological [agglutination] tests are sufficiently accurate to serve as a basis for freeing herds of the disease.
- (3) Clean herds, so indicated by the agglutination tests carefully applied and interpreted, can be maintained clean year after year.
- (4) Herds thus maintained show a breeding-efficiency far above that which is recorded in herds which contain many animals that react to the serological tests.
- (5) Other things being equal, herds that are entirely clean are the best breeding-units that can be obtained. Those that consist entirely of reactors, carefully culled, can be made to show fair breeding-efficiency. Those consisting of reactors and non-reactors in association show a minimum breeding-efficiency as compared with the two other groups.
- (6) Clean units may safely be recruited with young stock from infected units, provided the serological tests are made the basis of the transfer. Thus the infected unit may often be made to serve as a source of some income until the clean unit can be established, and the blood lines that the breeder prizes can easily be perpetuated.
- (7) Testing abortion disease out of a herd or unit and keeping it out is the only known successful way to handle it.

These conclusions fully support the views held in New Zealand. Dairy-farmers are advised to have a blood-sample taken from each member of their herd. This can be done by the farmer himself in the following manner :—

- (1) Procure $\frac{1}{2}$ oz. medicine-bottles with corks to fit, one for each head of cattle of breeding-age on the farm. Boil such bottles in a billy, and dry them in the oven. Cork each bottle and label it ready for taking to the cow-shed. Each bottle must be dry, must be sterile, and must be labelled with a mark distinguishing the respective animal.

(2) Cut the hair from the tip of the tail of the cow with scissors so that the blood will run into the bottle without touching the remaining hair. Do not destroy the whole "brush," however, as such would be unsightly, more particularly in pedigree herds.

(3) See that the end of the tail is cleaned. This is done preferably with a cloth soaked in methyated spirits, but the tail must be dry before the blood is taken.

(4) Cut the tail with a *sharp* knife longitudinally in the centre for the last inch. Give a good firm cut. Do not get your fingers in the way at the back of the tail, because the knife should cut right through, and only the cow's blood is required.



HOW TO TAKE THE BLOOD SAMPLE.

(5) Allow the tail to hang down straight, and do not apply any pressure with the fingers or the flow of blood will stop. Should bleeding be too slow the cut may be lengthened or deepened, but if the bleeding is too fast the cut may require tying with a strand of hair from the tail.

(6) Fill the bottle, if possible. A full bottle helps the sample to carry well in the post. Also, if bottles are left standing until the blood is thoroughly clotted there is less likelihood of spoiling.

(7) Send the samples by rail or post to the Officer in Charge, Veterinary Laboratory, Wallaceville, per Private Bag, Wellington. They must reach the Laboratory without delay. Pack securely to obviate breakage, and enclose name and address. A separate letter should also be sent, so that the veterinary officer testing the sample may know the state of the herd so far as this is known to the farmer.

A SURVEY OF PUMICE SOILS.

THE SUBSOILS OF ROTORUA COUNTY.

(Continued.)

B. C. ASTON, Chief Chemist, Department of Agriculture.

IN the first portion of this article, published in last month's *Journal*, endeavour was made to show the great influence on the surface soil exerted by the subsoil texture. For the purpose of photographic presentation of subsoil sections (page 297) exactly opposite examples were selected. Where the subsoil was non-permeable or difficultly permeable, swamp with its typical vegetation specially adapted to withstand stagnant moist conditions developed, forming a pure association of raupo or bulrush. Where the subsoil was easily permeable a highly aerated leached soil resulted, showing at the edge of the section where extreme droughty conditions prevailed a growth of that typical drought-resistant plant (or xerophyte) gorse, although the rainfall is some 60 in. annually. In between these extremes in this county one does not need to travel far to detect all grades of examples showing the influence of subsoil on the water content of the soil, and the consequent response of characteristic vegetation suited to dry-soil conditions on the one hand or wet-soil conditions on the other.

Results of Mechanical Analysis.

By mechanical analysis is meant the separation of the soil by purely mechanical (not chemical) methods into a number of groups of particles, each group containing only particles of a limited range in size. To each group is given a name which, although taken from everyday English, is here used in a definite sense and intended to convey the idea of a definite fixed texture varying only within narrow limits. From the proportion in which each group is present in a soil it is possible to predict the general physical properties of that soil.

In soil science the names given to the differently sized groups are, in the descending order of magnitude, "stones," "gravel," "sand," "silt," and "clay." By adding the qualifying words "coarse" or "fine" to each—except the "stones" and "clay"—are obtained terms which enable the soil to be represented in eight different fractions. This now gives a means of classifying soils of similar origin and composition when situated in similar climates, and classification is the first essential to the effective study of any kind of natural phenomena. The practical man may argue that he knows a sand from a clay soil without analysing it. It may be readily conceded that he can tell extremes, but even the practical man would stand appalled at being asked to assign a character to any mixture of eight different ingredients, a task which mechanical analysis can and will do. In fact, by this means one is enabled to compare soils from any part of the world having the same climate, for, as Sir John Russell has aptly said, "the soil is the child of the climate."

It is, however, one thing to attach a certain definite numerical character to a soil and another to interpret that character. Soil science is not yet advanced to such an extent that predictions may be made as

to what will occur in the field with a soil having any known combination of differently-sized particles as shown by mechanical analysis, although it is a method by which soils may be classified and compared, and, broadly speaking, their behaviour under changes in conditions brought about by climate, tillage, and manuring explained. With a mechanical analysis of a soil one need not be afraid of falling into the somewhat common error of calling a silt a clay, a distinction which conveys a very great difference.

Now, although mechanical analysis can reveal the proportion of each differently-sized fraction, it cannot tell how these particles are arranged to form what is known as "soil-crumbs." A soil is not a mere indiscriminate mixture of coarse and fine particles. Certain of the finer particles tend to run together into aggregate masses, and it is these "crumbs" which are largely responsible for the tilth of a soil. Alkalis such as carbonate of soda break down these crumbs and "deflocculate" the soil, while lime carbonate (or bicarbonate as it exists in the soil solution) acts in the contrary direction, causing the particles to run together. The smallest amount of free carbonate of soda in the soil solution has a very deleterious effect on the mechanical state of the soil: it forms "sodium clay." When "sodium clay" is acted upon by the application of carbonate of lime (ground limestone) sodium carbonate is formed again, and is free to recommence its vicious cycle; but if instead of ground limestone gypsum or land-plaster (sulphate of lime) is applied calcium clay is formed and sodium sulphate is liberated, which is not alkaline, and may be washed out of a soil in the drainage-water.

Something similar to this may be one cause of the deterioration going on in parts of the Hauraki Plains* in the course of "breaking in" a mangrove-swamp country originally charged with salts of sea-water, which would act as flocculating-agents for a time and improve tilth and fertility. When most of the salts have been washed out sodium carbonate may be formed in the soil, and a breaking-down of the soil-crumbs ensues to such an extent that capillarity and what is known as tilth are destroyed, while in summer a droughty condition may result, accentuating the effect of any poisonous salts or alkalis. The quick death of pasture at certain points on the Hauraki Plains may be due to the poisonous action of magnesian salts derived originally from the sea-water. After those of soda the next most abundant salts of sea-water are those of magnesia. The drainage subsoil water taken from a depth 3 ft. below the surface is highly charged with magnesian salts. The remedy may be to land-plaster the area, but further experiments are on foot to determine the exact treatment that a laboratory study of the soil can suggest.

As previously mentioned, land-plaster is hydrated sulphate of lime or gypsum. It is much more soluble in water than carbonate of lime, and effects notable improvement in the case of calcium-hungry soils or magnesia-sick soils. It is therefore suitable for treating many areas in districts containing serpentine rocks and the soils derived from them, which are rich in magnesia. It should be noted that much smaller

* For an account of this type of country, with analysis of soils, see article in this *Journal* for June, 1914. "The Hauraki Plains: Some Notes on the Soil."

quantities of gypsum may be effective than are required of ground limestone; 4 cwt. per acre is a fair dressing. (See article, "Magnesia and Plant Growth," in the *Journal* for December, 1915.) It is worth remembering that superphosphate contains more than half its weight (60 per cent.) of sulphate of lime, so that for every 3 cwt. of superphosphate more than 200 lb. of sulphate of lime is being applied per acre.

There are some highly nutritive fodder and pasture plants which are able to grow well in a soil containing a large proportion of sea-salts, and are accordingly to be found flourishing in many maritime estuarial situations subject to seasonal tidal submergence with salt or brackish water and consequently receiving deposits of salts in the soil when the water has drained away. There are other plants which do not grow wild but flourish when cultivated on salty lands, and it is probably no coincidence that some of these plants have been derived from ancestors—for example, colewort and *Beta maritima*—which originally grew in salty littoral situations. All plants belonging to the family *Cruciferae* would probably do extremely well in salty soils, such crops as turnips, kale cabbage, kohlrabi, rape, mangel, and sugar-beet, the latter two belonging to the family *Chenopodiaceae*.

The treatment of lands suffering from such defects, which can always be traced to the subsoil influence, therefore resolves itself into attempts to (1) grow a plant covering or crops which will withstand the salty influence, and (2) to remove that influence. As a sward it would be hard to beat *Trifolium fragiferum*, or strawberry clover, which flourishes in many salty areas throughout the North Island at sea-level, notably at Kaipara Harbour and at Himitangi, near Foxton. Such a sward, however, would provide an unbalanced ration, which would have to be supplemented by fodder of a lower protein content. The food value of strawberry clover is considered by practical farmers to be very similar to that of white clover, and it certainly has an amazing habit of establishing itself and spreading in brackish stations, where it is greedily sought by stock.

Mention of Himitangi brings yet another instance of subsoil influence from which one may derive instruction, for here the soil and subsoil is the usual dune-sand of the North Island west coast, consisting of about 90 per cent. of sand of uniform grain. The salt here cannot influence the textures prejudicially, owing to the absence of fine particles and the resultant soil - crumbs. The porous subsoil therefore allows the excess of salt to drain away to the watertable.

The experience of European countries having lands subject to salt-water invasion indicates that where the soil is argillaceous (clayey) there are good yields at first, but that when the excess of salts is washed away into the subsoil layers the results rapidly go from bad to worse.

It may be seen, therefore, that with very porous coarse-textured soils such as that of dune-sands and coarse pumice soils, where the physical conditions are such that salt cannot alter the texture by flocculation and deflocculation, disturbances in the fertility due to this cause cannot occur. In this type of soil the difficulty is to obtain a denser packing of the soil-particles, so that the evils due to excessive mobility and porosity—lack of water-holding power—and the consequent liability to suffer from drought and leaching of plant - foods may be diminished. In

fine-textured clayey and loamy soils, on the other hand, where the particles are already fine enough, and the necessary tilth has been induced by a judicious flocculation of the finer clay particles and admixture of organic remains, enabling the soil to be aerated, puffed up, and lightened, a breaking-down of the soil-crumbs by the ultimate action of salt water upsets in a short time the work of many years that was required to make it a fertile medium for plant-growth, capillarity is diminished, the soil pores are blocked by fine particles, air cannot enter, water becomes too abundant in wet periods and deficient in dry periods, and a general stagnation of life in and on the soil follows.

One of the most convincing examples of the value of mechanical analyses of soils is its use to differentiate soils in their capacity to grow the different qualities of tobacco, for, given suitable climatic conditions, the type of tobacco produced is determined by the soil, and particularly by its mechanical and physical condition. For instance, a clay soil gives a heavy-cropping tobacco which cures to a dark-brown or red colour, whereas a sandy soil gives a thin leaf curing to a yellow or light-red colour. American experience has proved that in the same locality and under the same climate quite different kinds of tobacco may be produced in direct relationship to the character of the soil. All tobacco soils should be well drained and have a high humus content.

Milton Whitney, the United States Government Soil Chemist, as head of the Bureau of Soils in the "nineties," did much to spread correct information regarding the types of soil on which to grow the highest quality of tobacco, and now the United States produces more tobacco than any other country in the world. Whitney, by the use of mechanical analysis, proved that certain soil areas of the Connecticut Valley were practically identical, as regards texture and water content, with certain areas in Florida upon which the finest of cigar-wrappers were grown from Sumatra seed. Experiments were accordingly made on one of the Connecticut areas, using the same seed and methods of cultivation and curing employed in Florida, with the most satisfactory results. Whitney estimated that this additional area made available would lead to a quality of tobacco being grown locally which hitherto had to be imported to the amount of six million dollars annually. New Zealand is becoming a tobacco-growing country, and our experience is likely to accord with that of the United States.

In New Zealand are all types of soil and many climates. During the past season the writer observed some fine tobacco growing in the Rotorua district. It seems extremely probable that a very fine and valuable quality of leaf could be grown in one of the types of pumice in which the "humus" content is high. Experiments at the State Forest Service nursery at Whakarewarewa have proved that the humus content may be greatly increased by green-manuring, so that if not high enough the organic matter can easily be reinforced.

The mechanical analyses of the subsoils of the northern part of Rotorua County are given in the accompanying tabular statements, and reference should also be made to the map published last month. It will be seen that the texture of the subsoils, which depends on the differently-sized particles of soil, is remarkably uniform over wide areas. Uniformity of character in the second 9 in. of soil closely follows uniformity in the top 9 in. These soils and subsoils are all deposited from

67	"	5:58	35:07	24:19	17:71	5:38	1:50	2:50	7:16	9:7	Mokoia Island, 1,000-1,300 ft.
87	"	4:64	33:82	25:38	13:45	4:76	2:0	2:8	10:9	Trace	Taken from Whittaroa clearing
89	"	6:55	34:71	20:57	12:01	5:50	1:70	3:7	11:5	"	Matua Road, near above sample, 1 mile from main road.
631A	"	7:8	64:6	13:1	6:5	3:6	1:1	0:8	3:4	38:6	Rototiti S.D.
Sandy Sills.											
S 455	Sandy silt	0:40	22:91	26:88	18:15	4:39	2:3	6:22	13:64	Trace	C. Hemmings, Mamaku.
463	"	0:45	24:9	30:3	18:2	4:6	1:55	5:4	12:98	"	Steeles' old mill, Leitchfield Road.
479	"	1:45	33:76	24:86	17:26	4:83	1:2	31:96	11:16	2:3	Belmont Estate.
505	"	1:54	24:23	22:10	17:98	5:97	4:0	10:90	14:34	Trace	Hemmings', Mamaku.
664	"	0:45	19:13	26:56	22:17	7:78	2:2	6:80	12:54	"	Beech forest area. Steeles' mill
666	"	0:50	24:67	28:35	21:76	5:88	1:0	3:6	11:44	"	Pasture between Steeles' old mill and Wahi Company.
T 506	"	2:25	29:92	29:88	16:92	5:09	1:0	3:28	9:60	4:3	Hunt and Wrigley, 3E, Sections No 4 and No. 3B, Block Horohoro S.D.
T 508	"	1:79	29:30	27:24	19:70	5:51	2:10	3:06	9:20	Trace	Neville, No 2M and 3C, 2A, Block 4, Horohoro S.D
514	"	2:80	27:60	26:64	21:0	0:30	0:80	2:70	10:64	"	G. Grace, No 1M, No 3, Block 4, Horohoro S.D.
520	"	0:6	33:3	27:9	16:0	1:3	1:5	3:5	10:2	"	Philips, flat near bridge, Mamaku Plain Road.
522	"	1:4	31:8	29:0	14:3	4:3	0:9	4:4	11:3	"	Danzig, Mamaku-Rotorua Road
526	"	1:00	25:64	28:55	12:87	7:51	2:40	8:10	14:10	"	Section 12, Block 14, Mamaku-Rotorua Road.
530	"	9:9	27:1	26:7	16:8	3:8	0:8	2:7	10:8	11:1	Turner's change paddocks, Hamurana.
536	"	0:71	26:21	29:10	14:89	8:44	3:0	3:10	12:84	Trace	Mrs. Bullock, Mamaku (blind road), Section 1, Block Rotorua.
538	"	0:46	23:22	28:40	11:71	6:53	2:30	13:84	15:08	"	Section 1, Block 14, Rotorua, 1/2 mile nearer Mamaku than above
540	"	0:76	20:82	28:62	13:08	7:32	3:0	12:24	14:16	"	Section 1, Block 10, Rotorua, Mamaku-Oxford Road.
542	"	0:6	24:5	31:7	17:3	4:9	1:9	4:0	13:4	"	Martin, Tirau-Rotorua Road
544	"	1:3	25:1	31:3	18:0	5:1	1:3	4:2	12:1	"	1 mile west from Tarukenga Station.
546	"	1:6	25:7	29:4	20:9	4:8	1:0	3:3	11:1	2:3	Hampson, beside Tarukenga Station.
555	"	1:3	28:8	28:5	16:7	3:9	0:7	7:2	11:4	Trace	Middle terrace, 1,445 ft., Section 4, Block 4H.
557	"	1:4	26:7	31:9	16:1	3:5	0:5	6:6	11:8	"	Highest ridge, 1,675 ft., Section 4, Block H.
559	"	1:1	26:0	27:5	15:8	4:4	1:3	9:4	13:0	"	Highest terrace, forest 1,500 ft., Section 3E 1, Block 4.
561	"	2:3	38:4	27:3	16:1	3:7	0:8	2:1	7:9	Trace	Grassy flat, No 4, Block 4, Horohoro
573	"	5:9	28:9	24:8	17:5	3:6	2:6	2:3	12:8	"	Forest, junction Rotorua and Roy Roads.
575	"	4:1	25:7	27:2	21:0	4:6	2:1	1:7	12:1	1:9	Maden's flat, Roy Road.
577	"	4:9	28:3	25:9	16:3	4:1	2:6	3:1	13:8	Trace	Catley's, junction Roy and Lagoon Roads.
581	"	7:7	31:7	22:5	14:0	4:7	3:3	2:3	12:7	"	Oakley's, Lagoon Road.
591	"	3:1	29:9	25:7	15:7	4:3	2:6	2:7	11:1	"	Forest, Puwhenua Road
595	"	6:5	38:0	17:5	16:1	5:8	2:3	2:7	10:0	3:7	Mosach, Mangatou Road

MECHANICAL ANALYSIS OF SUBSOILS, ROTORUA COUNTY (NORTHERN PART)—continued.

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.							Stones and Gravel.	Location.			
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.			Loss on Ignition.		
597	Sandy silt	..	..	2.7	31.3	25.3	15.7	4.8	2.2	2.6	14.0	Trace	Lower slopes, Otane Wainuku. Fern slopes, Tauranga-Rotorua Road. Close to Whakarewarewa, in eucalypt forest, Tarawera Block 1. Hill above Whakarewarewa, opposite Block 10, Tarawera 4 Block.
615	"	..	..	7.4	26.6	23.4	16.0	4.6	1.1	6.3	13.2	5.0	
W 284	"	..	..	4.2	30.0	26.2	20.5	5.8	1.5	3.1	6.7	2.0	
W 286	"	..	..	4.6	32.7	28.7	17.4	4.0	1.1	3.4	6.9	1.9	
R 882	Fine gravelly sand	..	..	22.1	36.1	13.9	10.4	7.2	2.0	1.1	6.6	23.3	Virgin fern country, Mourea.
1109	"	..	..	17.3	43.2	10.3	9.4	4.4	2.3	2.8	10.6	4.8	Sander's, Rotoiti S.D.
1135	"	..	..	22.0	38.9	13.8	11.0	4.5	0.7	1.9	7.3	12.0	Lichenstein and Arnoldson's, fern slopes.
S 499	"	..	..	22.5	41.5	13.0	10.8	4.4	1.4	1.2	5.0	20.0	Rotoiti S.D., on ridge.
502	"	..	..	17.73	47.08	11.13	12.97	3.6	0.9	1.7	5.38	10.5	Rotoiti S.D., slopes of gullies.
T 176	"	..	..	21.47	53.36	7.49	5.37	3.78	1.1	1.30	5.08	11.8	Rotoiti S.D., Blocks 7 and 8.
W 83	"	..	..	17.28	55.38	12.37	6.64	3.61	0.90	0.52	3.12	8.8	Sample taken in rimu-tawa forest below Rotoiti Block 16, Section 6.
85	"	..	..	18.91	52.52	11.37	8.32	2.56	0.10	1.0	4.7	5.8	Open fern land, twelve miles from Okere. Top end eight miles from main road, opposite Scenic Reserve.
73	"	..	..	18.68	45.43	13.28	11.22	4.18	1.90	0.98	3.90	25.0	S. A. Pettybridge, Tikitere, ploughed paddock.
75	"	..	..	17.17	50.88	12.54	8.78	4.26	2.00	0.74	3.61	16.1	Rimu-rata-pukatea-tawa forest, two miles from Okataina, 1,245 ft.
420	"	..	..	18.33	47.99	10.95	10.07	3.51	1.0	2.2	6.1	19.6	Two miles south from Rotoiti, hillside, Rotoiti Block 12.
628A	"	..	..	25.3	38.9	17.9	8.1	6.4	1.2	0.7	1.3	80.0	Ruawahia, Block 3.
632A	"	..	..	21.6	62.0	6.1	3.8	3.5	1.0	0.6	2.0	25.0	Rotoiti, Block 16.
T 174	Coarse sand	..	..	14.83	42.95	14.26	12.15	4.87	1.6	2.0	5.08	10.8	Blocks 7 and 8, Rotoiti S.D.
W 77	"	..	..	10.89	61.97	14.11	6.27	3.30	0.30	0.36	2.02	9.8	Rimu-tawa forest, Hongi's Track.
W 447	Sandy loam	..	..	9.1	13.1	28.9	21.5	13.2	7.8	1.3	4.9	19.4	Between Lake Okataina and Gee's, Tarawera Block 3.
W 449	"	..	..	7.5	21.9	30.2	30.0	10.2	5.1	0.9	3.8	20.9	Block 3, Tarawera, between Lake Okataina and Okareka.

air, into which the particles were blown by a series of volcanic explosions. The particles in the greater area fell on tablelands and areas which were not subject to river-action; hence any weathering of the volcanic dust, &c., must have been accomplished merely by percolating rainwater, and the deposit was coarse enough to resist this action to a considerable extent. Thus both soils and subsoils now exist in a coarse-grained state, containing very little clay or silt—the fractions of a soil which contribute towards fineness of texture, water-holding power, and consequently fertility.

It is very necessary that such work as this should be performed in the most painstaking and thorough manner possible. The surveyor and his assistant, tramping over the country, collect samples by boring into the ground and carefully drawing cores from different depths. When the land has been cultivated or even sown in grass the work is laborious, but when forest or fern cover the terrain the task is much more difficult. The constancy to type which the tabulated figures prove exists over large areas is evidently due to extremely similar conditions operating over an extended period of time. It is no function of the soil chemist or surveyor to explain in detail how the different strata became deposited in their present position, and why in one place coarse- and in another fine-textured soils occur. Their occurrence may not square with current geological speculations, but, if so, it may be justly argued, so much the worse for the speculator, for the soil surveyor can affirm confidently that such soils do occur and in approximately the areas and situations stated. In support thereof the figures are given from which the maps are plotted.

(To be continued)

PLANT SPECIMENS FOR IDENTIFICATION.

THE following information is embodied in a circular issued by the Director of the Fields Division, and is commended to the attention of farmers and others forwarding specimens:—

Plants sent in for identification should be as complete as possible and include a portion of the roots. More than one specimen should always be sent if possible, and ripe seeds, when available, should be enclosed in a separate envelope. Two methods of packing are suitable, as under:—

(1) Wrap root and lower part of stem in *slightly* damp moss or several layers of damp newspaper; tie this wrapping on securely, lay plants in tin or box with loose paper, if necessary, to prevent undue shaking, and make airtight before enclosing in wrapper for posting. Plants should be cut only when absolutely necessary for package of reasonable size to be made.

(2) Lay each plant, spread out and as far as possible without parts overlapping, on about five thicknesses of newspaper; cover with final layer of several thicknesses, and tie flat between cardboard covers before wrapping for post.

The label, which should be preferably attached to the plants, should give particulars of growing-place of plant (such as pasture, turnip-field, wayside, &c.) and date of collecting.

Where the plant has no flowers always use the first method of packing, and leave plenty of the root-system attached so that the plant may be grown on to maturity if necessary. On no account simply wrap specimens up loosely in a single paper cover. Either of the proper methods entails no great labour, and greatly facilitates identification. Where the plants have to travel any great distance they should be sent by express transit.

Packages should be addressed to the Botanist, Plant Research Station, P.O. Box 240, Palmerston North.

THE LAMB MORTALITY INVESTIGATION.

NOTE ON THE 1928 SEASON'S WORK.

D. A. GILL, M.R.C.V.S., D.V.S.M., Assistant Officer in Charge, Wallaceville
Veterinary Laboratory.

THE investigation commenced in 1926 in Central Otago concerning the mortality among lambs about two to six weeks old was continued in the Maniototo and adjacent districts last spring. On this occasion the work was confined to the technical aspect of the question, and for this reason no detailed report will be published. This general note on the work of the 1928 season, however, will apprise the farming community that the investigation is not being allowed to lapse in any way.

The main line of investigation was concerned with the possible presence in the bowel of affected lambs of certain types of organisms which might induce the condition in question through producing an unusually large amount of toxins. No definite evidence of this was obtained, nor could any likely germs be discovered in the blood, cerebro-spinal fluid, or various organs. The work on the flora of the intestine is exceedingly difficult, and suitable cases are hard to find, but further intensive work on these lines has been planned for the future. Specimens were also obtained for use in various biochemical tests.

The most probable train of events, culminating in the death of the lambs, seems to be that the condition is due to toxins which are formed in, and absorbed from, the gut; that these toxins may be produced in the gut by bacteria which are common and constant inhabitants of the gut, and which normally lead a quite harmless existence there; that through some factor or factors connected with the diet these bacteria have been enabled to increase in numbers and to produce larger quantities, or possibly more powerful types, of toxins. This by no means precludes the possibility that such organisms may have simultaneously increased in virulence so that they now attack types of lambs that were previously immune.

It will be seen from this that while the writer is not in full agreement with what is popularly understood as the "overnutrition theory" he does consider that at rock-bottom some dietary fault is responsible for the mortality.

In addition to the above-mentioned work a large series of preventive experiments with the use of various mineral-lick mixtures was carried out, but no definitely beneficial effects were noted so far as the mortality was concerned. It may be also recorded that in several further cases where it was tried the preventive method of yarding for twenty-four hours every five to seven days gave good results, as it may be expected to do in all cases provided it can be properly and systematically carried out. Details of this method and other preventive measures were given in the *Journal* for March, 1928, pages 149-152.

An extensive programme of work for next season has been planned out, embracing preventive experiments as well as further investigations aimed at clearing up the true nature of the disease.

LOSSES OF YOUNG STRAWBERRY - PLANTS.

INVESTIGATION IN AUCKLAND SUBURBAN DISTRICT.

W. H. RICE, Orchard Instructor, Horticulture Division, Auckland.

DURING December, 1926, the attention of the Horticulture Division was called to the loss of some 150,000 strawberry-plants in the Auckland suburban district, due to non-establishment after planting. A preliminary survey showed that nine plantations were affected to variable degrees, the greatest individual loss being 40,000 plants. All these plantations were situated in the Northcote area, a district noted for the successful cultivation of strawberries since 1887. Local information went to show that the trouble had been first noted in 1921, in one plantation; in 1924 it was observed in three plantations, and in 1925 in six plantations. Strawberry-growers of this locality were very alarmed at the spread of what was termed a "mystery" disease, particularly as such a trouble was not known in the other strawberry-growing areas of the district.

The plants were first-year transplants set out in May, and under normal conditions should have made good root-action without any great development of foliage during winter. With the first period of open weather, usually during October, rapid growth takes place with normal plants, while in certain areas others will die which up to this time have been to all outward appearances identical. When lifted these plants were found to have made no root-action since planting, having evidently been kept in a green state by atmospheric moisture, and rapidly died under evaporation. This mortality continued to manifest itself, plants dying out according to the lack of roots made. If there were sufficient roots to maintain life the plants made new ones from the crown and grew quite well, though too late to be of commercial value. There was also a class of plant which had made some root, but which had died back, usually from the tip, as though the soil conditions had once been correct but later had become uncongenial.

Specimens were forwarded to Wellington for biological examination, and, no pathogen being found to account for the mortality, it was decided to carry out cultural experiments co-operatively with Mr. J. B. Tonar and the investigation committee of the Strawberry Growers' Association, Messrs. T. M. Shepherd, R. F. Kay, E. C. Walton, and S. Knight.

Factors which had to be considered as possibly contributing to the local trouble, and which were investigated during 1926, 1927, and 1928, comprised disease, manure burn, toxic soil conditions, physical condition of the soil, and drainage.

Disease.—Though laboratory investigation had failed to disclose any specific disease, it was suggested by some growers that bacterial infection was present and transmitted from one plantation to others through using common implements. This was not substantiated, and the reverse was demonstrated by one plantation which had no loss, although ploughed and cultivated during two seasons with the implements used alternatively on an area showing the greatest loss. Investigations were

extended to the plant-nurseries, but no trace of the trouble could be found there. Disease-transmission by plants was negated by the fact that plants from many and the same sources were found equally on plantations with no loss and on areas subject to considerable loss. It was impossible to reconcile the loss of plants with some undetermined disease, as plants which had all but succumbed to the trouble were moved to very light land and, though subjected to no treatment, fully recovered and made robust plants in the succeeding seasons.

Manure Burn.—The non-established root-system on affected plants was consistent with injury such as might be expected from recently applied artificial fertilizers. This could be further expected in that there is a tendency to apply such dressings to excess. As an example, it may be stated that a fair representation of the average dressing used generally throughout the district, and which has been applied annually for the past twelve years to one piece of land, is as follows: Ten days prior to planting, 5 cwt. blood-and-bone, 5 cwt. super (40-46 per cent.), 5 cwt. bonedust, 2 cwt. sulphate of potash; at time of cultivation (two at 4 cwt. each), 8 cwt. blood-and-bone; prior to mulch, 4 cwt. Peruvian guano: total, 1 ton 9 cwt. per acre from May to October.

Experimental dressings were made at various intervals prior to planting, but none of these influenced the degree of mortality under investigation, though application at the time of planting did injure the root-system. Quarter weights of the quantities of fertilizers specified gave better crop results.

Toxic Soil Conditions.—Many areas had been cropped with strawberries continually up to twenty-five years, during which time no rotational or green cover-crops to turn in had been grown. One plantation on which *paspalum* luxuriated in the off-season had never recorded the mortality, though situated next to the area on which the greatest loss had been experienced but on which no humus has been turned in for several years. To test the effect of soil-dressings, sulphate of iron, sulphate of copper, and sulphur, all at 3 cwt. per acre, were tried. The only variation noted, however, was greater luxuriance on the sulphur-treated land.

Physical Condition of Soil.—On the whole of the affected areas this was poor. The land is of a very heavy loam on dense clay subsoil, prohibiting any but very local effects of drains. This is intensified by lack of humus, and the excessive compacted condition due to non-rotation of crops and the heavy dressings of artificial fertilizers. There is also a local aversion to the use of lime for the strawberry crop, as growers endeavour to keep the land as acid as possible. Improvement of the physical condition of the soil by the use of green-manuring crops has been shown during the investigations to be of some importance, as the land has become of a texture that is difficult to drain, and under seasons of heavy rainfall rapidly becomes waterlogged.

Drainage.—Wherever loss was investigated it was always found associated with soil-saturation of extended duration. A factor influencing this condition is lack of drainage. Under-drainage is not practised to the extent it deserves; the beds are plotted out and surrounded by a surface drain, which, while it may trap water from a higher level, nearly always fails to carry away surplus surface water. It has been the practice when cutting these surface drains to open them up to a

depth of 12 in. and level back the soil only a short distance on to the beds, thus creating a central depression, and it is not uncommon to find that when the drains would be most useful they have silted up so as to be useless. There is also to be found, usually on hillsides, a class of land which has a hard-pan, causing excess moisture to come to the surface where the landfall is apparently good. This outcrop of water usually occurs where the land is patchy, and on the more loamy parts where one might think drainage would be good.

Repeated surveys of the affected plantations and experimental plantings disclosed the fact that where the land was elevated or depressed by faulty levelling prior to planting, the drier and more elevated parts grew good plants, while in the depressions and away from the influence of drainage the mortality was greatest. Further, on a new plantation in strawberries for the first time, and on soil of good physical condition, it was found where a tile drain was blocked that mortality was induced, progressive according to excess saturation near the drain bad and radiating outwards to nil. Though the mortality was never found except associated with excess water, instances have been noted of temporary excess water with no mortality. During the investigations one area only came under notice where non-establishment of plants could not be traced to a waterlogged condition of the soil, but on this area plants died out uniformly in rows on elevations as well as depressions, and the line of demarcation was acute between an area on which 30-per-cent. potash manure had been used ten days previously (the excessive salt of which apparently caused the mortality) and an area of good plants not so treated.

CONCLUSION.

Working on these deductions, recommendations were made to growers which called for green-manuring crops, adequate under-drainage, and avoidance of depressions on the surface level. Where these measures were put into operation they proved successful in the 1928-29 season. On one area of 35,000 plants, where the land was tile-drained and a crop of green oats turned under, with the usual programme of manures, the loss of plants due to the mortality under investigation was only three dozen, whereas in the previous season on the same land from a similar number of plants three thousand were lost. On another wet corner of a plantation where the mortality had been severe for two seasons, better drainage resulted in no loss being experienced in 1928-29.

Feeding of Calves.—It is a well-recognized fact in feeding economy, and amply illustrated in the case of countries specializing in baby-beef production, that a young animal will give a better return per pound of food eaten than an older animal, all other factors being equal. Reasoning on these lines, the store stage in an animal's life should if possible be eliminated and the young animal kept in a vigorous growing state right throughout. In our beef-producing herds where the calves are mother-reared, and when they are weaned under suitable feed conditions, there is no trouble from internal parasites. It is specially important in dairying districts where the heifer calves are reared that special attention should be paid to their feeding throughout the first year of growth.—*Live-stock Division.*

SOME COMMON AILMENTS OF PIGS.

D. MARSHALL, M.R.C.V.S., Veterinarian, Live-stock Division, Hamilton.

PIGS are very frequently kept under conditions which are far from natural. If numbers are herded together, yards become fouled and muddy, and disease, if it occurs, is more likely to spread. The following notes aim at giving practical points of advice to farmers in the diagnosis and treatment or prevention of some of the common troubles.

DIARRHŒA OR WHITE SCOUR.

Young suckers may be affected with a form of diarrhœa or white scour, which frequently results in death within two to three days, while those which survive suffer considerable check. One apparent cause is too generous feeding of the sow just before and just after farrowing. While the diet should be sufficient and varied, with a due proportion of flesh and bone-forming elements, it should not contain excess of protein substances such as meat or heavy meals.

The remedy is to reduce such foods or omit them from the sow's diet for ten days preceding and three to four days after farrowing. The provision for the pregnant sow of uncooked green food, for which the best is pasture grazing, has been found helpful. The addition of potassium iodide in the daily slop will have a beneficial effect on the unborn young. For pregnant sows a tablespoonful daily of a solution of 1 oz. of potassium iodide in 1 gallon of water will be sufficient.

As such outbreaks of diarrhœa may take on a contagious nature, cleanliness of the sties for the little pigs, with thorough disinfection of farrowing-pens for each successive litter, should be practised.

SORES.

Weaners and slips are very frequently affected by sores, which occur on any part of the body, but most often on the forehead, jaws, and shoulders. These vary in size from a shilling-piece up to 6 in. or 8 in. in diameter. They are slow to heal, and usually there remains a blemish, which, after slaughter, renders necessary the condemnation of the affected part. Where the pastern or foot is affected severe lameness may result.

The cause is the infection of small wounds by a dirt germ which is widely distributed in the soil, and which on entering such wounds multiplies and causes the death of surrounding tissue. Wounds may be caused in various ways, but from the common site of these sores on the face, jaws, and shoulders it is evident that the barbed wire generally used in the construction of pig-yards plays an important part. It has been observed that where netting and plain wire are substituted for barbed wire such cases seldom occur.

A close watch should be kept for these sores in the early stages, and at their first appearance they should be dressed with tincture of iodine until they dry up. Quicklime should be dusted round the feeding-places, and it is a great advantage to have the troughs on a raised wooden platform or grating, which provides better drainage. Pigs might be kept off the barbed wire to a certain extent by running a board along the bottom of the fence at any spot where they are inclined to nose through.

PARALYSIS OF HIND QUARTERS.

Apart from actual poisoning and parasites, pigs do not appear to suffer to any extent from digestive disease, but may show indirect results of defects in diet. One such effect is evidenced by paralysis in young growing pigs three to four months old. The affected pigs show loss of power in the hind quarters, and may move about on their fore legs, trailing the hind quarters on the ground. This affection is probably due to a failure to assimilate calcium phosphate from the food, and may be cured in three to four weeks, or prevented by adding a little cod-liver oil to the ration daily, or by giving a more varied diet, including a little new milk and green stuff, particularly clovers, with a small daily allowance of steamed bone-meal.

PLEURISY AND PNEUMONIA.

Many pigs after slaughter show lesions of pleurisy, which may be recent or old-standing and healed. It is doubtful if this causes any marked symptoms during life.

Pneumonia is frequent, and is evidenced by distinct signs of dullness and weakness, unwillingness to feed, cough, nasal discharge, and heaving at the flanks. While all forms should be regarded as contagious, some are markedly so, and spread quickly after the introduction into the herd of bought pigs suffering from the disease. Cold draughts are frequently a predisposing cause, and it has been observed that pigs lying under open-bottomed hedges through which cold winds blow suffer more often than those in open yards.

Little can be done in the treatment of pneumonia. Diseased pigs should be isolated as soon as observed. Where the outbreak persists, it is sometimes necessary to clear out all the pigs, plough up and lime yards, and disinfect sheds or build new ones in a fresh spot. Fresh lines of bought pigs should be kept apart from the general herd for a fortnight, until they are seen to be healthy.

TUBERCULOSIS.

It is rather unfortunate, from the point of view of impressing its importance on the farmer, that tuberculosis in pigs very seldom causes any noticeable symptoms. It is by far the most frequent cause for condemnation of pigs in the various bacon-factories and abattoirs, and it is astonishing to what extent the disease may sometimes be found present in a fat and apparently healthy pig.

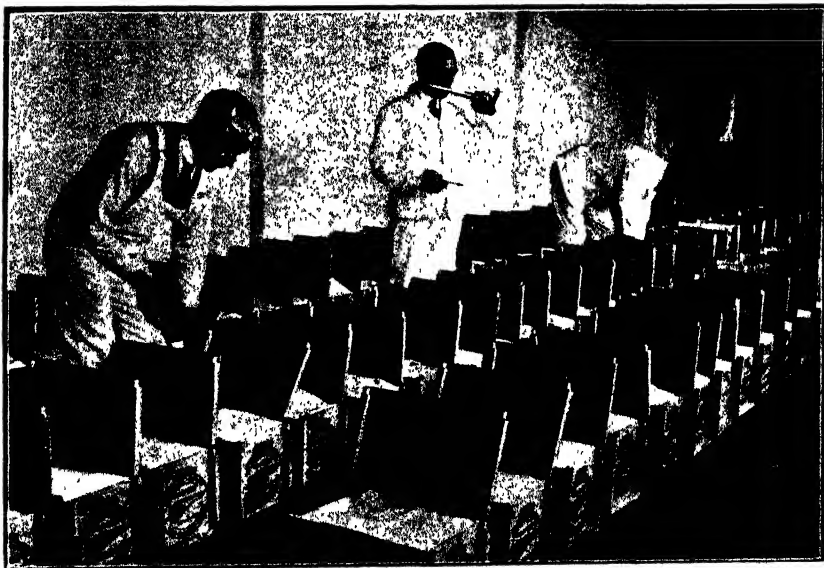
Once in a while an aged sow may show definite symptoms — poor condition, cough, and enlargement of the udder. While coughs in pigs are nearly always the result of one of the forms of pneumonia of a non-tuberculous nature, any enlargement about the mammary gland should be regarded with suspicion, as such enlargements are frequently tuberculous, and if so are a very grave danger to the suckling litter, which is certain to become infected.

Tuberculosis in the slaughtered pig may be recognized by the presence in the lymphatic glands about the throat region and elsewhere of white cheesy areas, and, in the worst cases, of similar nodules scattered throughout the lungs and liver and on the inner surface of the ribs.

In New Zealand tuberculosis in swine is believed to be nearly always due to infection by the bovine type of organism: that is to say, it is contracted from cows, and most probably from the milk. Where dairy-factory by-products, such as buttermilk, have been subjected at some stage to efficient pasteurization no danger exists in their use for pig-feeding. Where home separation of milk is in vogue, however, it may easily be seen how one cow liberating germs of tuberculosis with the milk may contaminate all the separated milk and infect pigs fed on it. Further, once the infection gains a footing in the yards and sties the soil and litter become contaminated, and remain a source of danger to successive crops of pigs.

The disease may be also contracted by pigs grazing in a field which is infected by the dung or discharges from a tuberculous cow. In the United States it has been found that a considerable proportion of tuberculosis of swine is due to the avian type of bacillus. While this has not been found to any extent in New Zealand, the presence of tuberculosis among poultry should always be regarded as a possible danger to pigs.

Methods of control are indicated by what has already been said. In the event of tuberculosis being found to any extent among pigs after slaughter, the feeding methods on the farm should be examined. If raw home-separated milk is being fed the dairy herd should be carefully scrutinized. Sties should be thoroughly cleaned and whitewashed, feeding-places and troughs cleaned, and contaminated yards turned over or shut up for a spell. Any sow with suspicious chronic enlargement or hardness about the mammary gland should be got rid of.



OFFICIAL GRADING OF NEW ZEALAND EXPORT BUTTER IN STORE AT AUCKLAND.

[Photo by H. Drake.

LUCERNE A LIME-RICH PLANT.

ANALYSES OF OTAGO SAMPLES.

B. C. ASTON, Chief Chemist, Department of Agriculture, Wellington.

A SUGGESTION was made in the issue of this *Journal* for September last (page 151) for growing on lime-depleted soils, where the pasture shows signs of calcium deficiency, perennial and deep-rooted plants, such as legumes, which are usually characterized by having a high calcium content compared with the species of Gramineae, the family to which all the grasses belong. To what extent the calcium of the natural ration could be supplemented by such means is now a matter of inquiry.

The first plant to suggest itself was naturally lucerne, or alfalfa, that king of green-fodder plants. Lucerne is, however, a plant which loves a dry climate, and the King Country—the district with which the *Journal* article dealt—has an excessively moist climate, especially at an elevation of 1,000 ft. in the vicinity of Te Kuiti. Lucerne also loves a calcareous subsoil, and here is pure limestone, although buried under some feet of volcanic dust or mud. The matter is evidently one for experiment, for it is quite possible that the expense of establishing the lucerne in the particular area (Mairoa) where it is most desired to grow it would not warrant employing it in competition with red clover, which gives good results there when well manured. It is to be noted, however, that lucerne under favourable conditions will yield in a season treble the weight of fodder supplied by red clover. There are other legumes which might be mentioned, but consideration of these must be deferred to another article. The aim of the present article is to show the paramount position that lucerne occupies as a medium for supplying a supplementary food of very high nutritive value and containing a high amount of calcium, an amount which under favourable conditions may amount to six times the quantity to be found in the dry matter of the poor hill pasture. It is well established that lucerne, in addition to being an excellent food, exercises a specially good influence on the health of stock.

It must be premised that the samples of which the analyses are given in the accompanying tabular statement are from samples collected in Otago by Mr. C. M. Wright in October and November, 1927, and February, 1928, and that this part of New Zealand has proved to be eminently suited for the growth of lucerne. The amounts given for calcium are exceptionally high, but the writer has the greatest confidence in the accuracy of the results. Each sample was done in duplicate by Miss E. B. Kidson and Miss R. Strand, assistant analysts of this Department's Chemical Laboratory staff, and the results of both determinations, the mean of which is adopted here, agree well with each other.

It is hoped to obtain further samples of lucerne grown under less favourable conditions than those obtaining in Otago, and of other plants more likely to succeed in the moist climate and calcium-deficient soils occurring over so much of the North Island.

Von Wolff's analysis (quoted by Hopkins) of alfalfa (this being the name always used in the United States and other parts of America) shows that lucerne contains 3.28 per cent. of calcium oxide (lime), and

Chemical Analyses of Lucerne Samples from Otago.

Results are percentages calculated on the water-free sample.

Lab. No.	Locality.	Date collected.	Ash.	Crude Silica (SiO ₂).	Iron Oxide (Fe ₂ O ₃).	Phosphoric Anhydride (P ₂ O ₅).	Alumina (Al ₂ O ₃).	Magnesium Oxide (MgO).	Manganese Oxide (Mn ₂ O ₄).	Chlorine (Cl).	Nitrogen.	Sulphuric Anhydride (SO ₃).	Manurial Treatment.
8005	Gimmerburn	10/27	12.63	0.47	0.028	1.46	2.63	0.88	0.0075	..	..	..	1925, 7 cwt. limestone and 1 cwt. super per acre.
8013	Ranfurly	10/27	14.56	0.57	0.036	1.44	3.42	0.59	0.0079	..	..	..
8014	Ranfurly	10/27	12.02	0.37	0.035	1.26	2.65	0.89	0.0077	..	..	..	Special lucerne manure and super.
8018	Oamaru	10/27	12.95	0.51	0.038	1.39	3.66	0.64	0.0089	..	..	..
8019	Ngapara	10/27	12.54	0.56	0.0099	1.26	3.46	0.58	0.0061	..	..	..	Sown 1926 with 6 cwt. ground limestone per acre.
8021	Gimmerburn	11/27	12.94	1.19	0.038	1.13	2.51	0.96	0.0065	..	..	..
8023	Patearoa	11/27	13.41	0.37	0.021	1.23	3.82	1.05	0.0140	..	..	..	1925, 2 cwt. super per acre; 1927, 6 cwt. limestone per acre.
8024	Patearoa	11/27	12.88	0.27	0.019	1.00	3.04	1.04	0.0100	..	..	..
8026	Ida Valley	11/27	15.43	1.50	0.054	0.90	3.72	0.97	0.0110	..	3.60	..	No manure
8027	Ida Valley	11/27	13.68	0.17	0.017	1.12	3.93	0.66	0.0080	..	..	..
8028	Gimmerburn	11/27	15.70	1.31	0.043	1.26	3.58	1.20	0.0090	..	..	..	Sown with 4 cwt. limestone and 1 cwt. super per acre each year.
8029	Gimmerburn	11/27	13.66	0.87	0.027	0.91	3.42	0.93	0.0130	1.10	..	..
8032	Wedderburn	10/27	14.85	0.61	0.032	1.35	4.09	1.09	0.0150	0.40	..	1.21	Ditto.
8035	Wedderburn	11/27	14.06	0.79	0.038	1.35	3.13	0.89	0.0130	0.29	..	1.13	
8037	Kokonga	11/27	12.62	0.33	0.021	0.90	4.26	0.53	0.0046	..	4.70	1.09	1926, 2 cwt. super per acre.
8038	Ranfurly	11/27	13.07	0.36	0.020	0.93	3.49	0.60	0.0049	..	..	0.64	
8039	Gimmerburn	11/27	13.60	0.90	0.032	0.83	3.26	0.84	0.0062	..	3.95	1.33	1922, 7 cwt. limestone per acre and special lucerne manure;
8040	Gimmerburn	11/27	11.80	0.31	0.019	1.15	3.93	0.63	0.0043	..	5.28	0.87	
8041	Oturehua	11/27	14.54	1.07	0.041	1.46	2.74	0.68	0.0086	..	..	1.29	1924, 3 cwt. super per acre; 1925, 2 cwt. super per acre; 1926, 1½ cwt. super per acre.
8044	Ranfurly	2/28	14.04	0.62	0.023	1.32	3.22	1.17	0.013	..	5.76	1.07	7 cwt. limestone per acre at sowing; later, 2 cwt. super per acre.
8045	Ranfurly	2/28	14.51	0.50	0.019	1.43	3.09	1.01	0.010	..	5.89	1.28	

NOTE.—The writer has checked the results by duplicate analyses, using a different method for phosphoric anhydride and calcium oxide in the cases of Nos. 8019, 8014, 8018, 8041, 8040, and 8045, and obtained practically identical figures. For alumina the figures he obtained in percentages were: for No. 8013, 0.04; for 8014, 0.084; for 8018, 0.06; for 8019, 0.23; for 8044, 0.064; and for 8045, 0.077. It may be regarded as probable that the samples were contaminated slightly with earthy matter, which would account for the high iron content in most cases.

that when the crop is cut in early bloom lucerne hay contains 3 per cent. of calcium oxide, both calculated on the dry matter ; whereas red and white and alsike clover hay contain, according to the same authority, from 1.6 to 2.82 per cent., depending on the stage of growth, and young red clover contains 2.8 per cent., in bud 2.49 per cent., and in flower 2.38 per cent. The general superiority of lucerne as a calcium feeder will be seen from these figures as well as from the analyses of the Otago samples, which latter show an average calcium-oxide content of 3.39 per cent.

THE ECONOMIC SIGNIFICANCE OF SYSTEMATIC BOTANY.

Lecturette by Dr H. H. ALLAN, Systematic Botanist, New Zealand Plant Research Station, Palmerston North, broadcast from Radio Station 2YA, Wellington

ONE side of the work of the Plant Research Station deals with the applications of systematic botany, and I propose to speak of one aspect of the investigations being carried out. Systematic botany is that branch of science which deals with the classification of plants according to their relationships. The common-sense observation of mankind long since arrived at a rough classification rough because essential differences were often overlooked owing to superficial resemblances and gave names to the classes observed, such as grasses and buttercups, oaks and elms, and what not. But systematic botany endeavours to go deeper than common observation, to disentangle its confusions, to be more precise, and to add experiment to observation. Now, I take it that most systematic botanists engage in this task because it appeals to their natures, just as the philatelist collects stamps and studies perforations and water-marks because he likes so to do. But this must not lead us to suppose that the work has no value except as a hobby. I grant that the extent of the economic value is only beginning to dawn upon us. Until quite recently, for example, botanist and sawmiller alike were content to class together under one name two species of southern-beech, although the timber produced by the one is quite different in quality and uses to that produced by the other.

The horticulturist and the practical plant-breeder have in this matter left the pure botanist far behind in many respects. To Peter Bell, we are told on unimpeachable authority, the yellow primrose by the river's brim was a yellow primrose and nothing more. To the botanist of Peter's day it was even less— it was *Primula vulgaris* and nothing more. Yet the keen-eyed horticulturists saw that there were many distinct forms called by the one name, just as the term "hat" covers a multitude of forms, from that made famous by Charlie Chaplin to the quaint affairs worn by the modern woman. By skilfully exploiting the possibilities offered by the mixed population presented to him by nature, the plant-breeder has produced our modern races of primroses, cowslips, oxslips, and polyanthus. So, too, the common field-daisy is still to most botanists *Bellis perennis* and nothing more. He

passes over, almost with contempt, as trivial variations, those minute differences that have been seized upon by the breeder, and from which have been derived the numerous fine types of daisy that now adorn our garden borders. To the botanist the turnip is still apt to be *Brassica campestris* and little more; whereas to the gardener and the farmer there are the scores of forms of swedes and turnips and rape, with their different characters and uses.

The botanist of the new school, however, is beginning to study, and in part to understand, the causes of the existing diversity within these groups—to assess the status of the forms, and to explain the results the breeder has obtained. He is more and more fully realizing the need for a very minute analysis of the multiformity of nature; and, although he is still at the beginnings, he is already in a position to suggest more accurate methods of procedure—methods that will achieve the ends aimed at with a smaller amount of wasted effort. I may refer to the remarkable work accomplished by Erwin Baur in the snapdragon (*antirrhinum*) group as an example of what can be done. This worker has produced hundreds of forms of snapdragons, can combine their colours at will, knows their pedigrees, and can accurately predict the behaviour of their offspring.

In thus endeavouring to analyse the situation the modern botanist (and New Zealand botanists, under the inspiring leadership of Dr. Leonard Cockayne, F.R.S., are taking no small share) has developed certain important conceptions, and for the sake of clarity has had to invent a series of terms. And some of these terms are necessary for my argument.

An examination of the individual plants and their behaviour shows that there are to be found groups of individuals all closely resembling one another in many details, and producing offspring exactly resembling themselves. These true-breeding groups we term jordanons. Certain jordanons, while differing constantly in some features, are found to have a number of points in common. These closely related jordanons we speak of as forming compound species. An ordinary field of Hunter's wheat is an example of a compound species, some of the jordanons being better, some worse yielders. One such jordanon of high quality has been isolated by Dr. Hilgendorf, of the Canterbury Agricultural College, and is now well known under the name of College Hunter's. So, too, the common sow-thistles of our gardens are made up of two different compound species, each with a number of jordanons within it. The compound species with non-prickly leaves we call *Sonchus oleraceus*, and the prickly one we call *Sonchus asper*; and to the jordanons, when isolated, we may give further varietal names to distinguish them one from another.

We find, moreover, that these jordanons may hybridize, and that the offspring of the cross are not constant true-breeding forms, but a medley. So we recognize the category of hybrids. Man, being a hybrid, does not have children exactly resembling their parents—a fact that sometimes appears to give the offspring great satisfaction.

Again, we find that the environment has a remarkable effect upon plant-form. Two individuals of the same jordanon, growing under diverse conditions, may so differ in appearance that until we bring

them together under like conditions we may fail to realize their essential identity. The grass known to the farmer as brown-top may, when growing among scrub, become a climbing-plant, looking very different from the same species growing as an ordinary member of pasture. These inconstant environmental forms we call epharmones. All workers with cultivated plants are dealing with epharmones. No matter how excellent may be the jordanon of parsnip, potato, timothy-grass, or lucerne that he is growing, he will not succeed in getting the maximum result unless he provides the environment that will produce the best possible epharmone.

The systematic botanist, then, has as his task the sorting-out of the jordanons of the compound species, so that the plant-breeder and the selectionist may test them and lay hold on those best suited for particular purposes. Each jordanon will have its own special features, whether good or bad. It is no longer sufficient, for example, with perennial rye-grass to recognize such so-called races as "Southland," "Canterbury," "Sandon," Hawke's Bay," "Poverty Bay," "Irish," and so forth, and to charge or pay varying prices according to name. In each group the different jordanons have to be sorted out and their qualities tested—no mean task! It may be that there is lurking in Southland a jordanon that will challenge the very best that Hawke's Bay can offer! We have also to recognize that the different jordanons are apt to hybridize with the jordanons of that other important compound species, Italian rye-grass. It may be that there are among the hybrids forms valuable for the farmer, but it is clear that he needs to know whether the seed he sows is that of a pure strain (a jordanon) of either species, or that of a hybrid mixture.

Compound species after compound species awaits study on these lines. Dr. Yeateš, of Massey Agricultural College, for example, is working with one important fibre plant, *Phormium tenax*, a great mixture of jordanons and hybrids of diverse qualities. The Plant Research Station is working at various grasses and clovers.

Nor can weeds be left out of account. Attempts are being made to control some of our weed pests by insect-attack. My views on the prospects of success it is not here necessary to discuss. But it is already clear that for any real progress to be made we shall have to study intensively the systematics of our weed flora—a subject, I may say in passing, that has had but little attention paid to it in the past. It is aimed to control, for instance, St. John's wort, ragwort, and blackberry by these methods. It must be realized that these common names are but group-names for a number of distinct jordanons, coupled with their hybrids. Every housewife knows that blackberries vary enormously in their jam- and pie-making qualities. Will our insects attack "blackberry" in general, or will they discriminate, and attack only certain jordanons, allowing others to go unchecked? That insects are apt to discriminate closely between different food plants is, I understand, a fact. Whether different jordanons of insects can be found to attack different jordanons of plants is a problem I thankfully leave to my entomological colleagues. Science is one and indivisible, and all branches must afford their quota of information for a successful issue to result.

Further, it is not sufficient for us to know that there is growing in various parts of Auckland a weed called "sneezeweed." We have to determine what jordanons are actually present. Some of these in their American home—where we could wish they had stayed—are comparatively harmless, some are more or less seriously poisonous. Of course we may let matters slide till we find that serious loss of stock is or is not being incurred, but it is better to forestall any possible harm if we can. In general, we need to know as early as possible of the occurrence of species not before recorded, as a stitch in time saves many more than nine. There has just been sent to me, for example, a specimen of buffalo-burr, *Solanum rostratum*, an extremely undesirable annual plant from America, which, incidentally, provided the original food of the Colorado potato-beetle.

Now, this means also that the botanist requires definite names for his jordanons. It is often asked, Why use these mysterious, generally cumbersome Latin names, when there are common ones that everybody understands? The trouble is that the common name is so often applied in an extremely loose manner, not merely to different jordanons within a compound species, but to quite different species and genera. A single jordanon may also have a considerable number of different names applied to it. I much prefer the common name "snapdragon" to "antirrhinum" for the well-known garden-flower, but if I want to get a particular form for my garden I need a special name, be it Black Beauty or Snow Queen or Maiden's Blush. In New Zealand we all know what compound species is being referred to when we speak of dodder. But in England that name refers in one part of the country to *Spergula arvensis* (known here variously as spurrey, yar, or devil-weed); in another part of the country to *Cuscuta epithymum* (dodder as we know it); and in still another part *Cuscuta* becomes "hairweed," while *Spergula arvensis* becomes "mountain-flax." Indeed, *Spergula arvensis* rejoices in still other names—beggar-weed, bottle-brush, cowquake, farmers' ruin, toad-flax (to us this is the name for *Linaria vulgaris*), franke, lousy-grass, make-beggar, pick-pocket, pick-purse, poverty weed, sandweed, yarrel, and so on. There are at least eighty names applied to the little, inoffensive, woodland plant *Orchis mascula*, and to how many species the names "sheep's burr" and "devil-weed" have been applied nobody knows. Add to this that a similar confusion applies to the common names used in other countries and in other languages, and it is clear that the common name can have no sort of international currency. But the botanist the world over will know what I mean if I ask for *Spergula arvensis*, and I may get particular jordanons to compare with ours—say, variety *maxima* from Denmark, *nana* from the Channel Islands, and *sativa* from Asia Minor.

I do not mean to say that all is as yet plain sailing, nor to deny that the botanist, in his efforts to obtain definiteness and uniformity of usage, appears often to make confusion worse confounded by his name-changing propensities. It comes hard, for instance, after so many years, to be asked to call by the name *Metrosideros excelsa* what was familiar as *Metrosideros tomentosa*, and the unambiguous and beautiful name "pohutukawa" seems much preferable, if we forget for the moment that few outside of New Zealand will have any knowledge of

that name. But on the whole, and despite certain temporary inconveniences, matters are being gradually straightened out. Think for a moment of the confusion and monetary loss caused by the tangled-up nature of our popular names for the different species of southern-beech in New Zealand, with their different timber-values. Think of the ease and advantage if we could bring it about that the names red-beech or silver-beech should always be applied to one species and one species only. The blue lupin is well known in Australia as a valuable sheep-feed; the blue lupin is well known in New Zealand as a green-manure plant of value. But the blue lupin of New Zealand is *Lupinus angustifolius*, and that of Australia is *Lupinus hirsutus*. The Australian farmer is naturally going to be disappointed if, obtaining seed of blue lupin from New Zealand, he expects to get the species he has learnt to value as a sheep-feed. So too with canary-grass, it is important to know whether you are getting the perennial valuable *Phalaris bulbosa* or the annual worthless *Phalaris minor*. Mr. Johannes Andersen has done good service in this direction by collecting the popular names applied to our native plants and recommending particular ones for adoption. It cannot be gainsaid that it is of great economic importance that we have accurate names for our plants.

In conclusion, I wish to refer to the work of identification of plants attempted at the Plant Research Station. There have been recorded and described over 120,000 species of flowering-plants for the world, and the number of garden forms is legion. Although the majority of plants sent into us are more or less familiar and easy of naming in a general way, it cannot be expected that a few small heads can carry all the knowledge that may be required. Nor is the literature as yet available to us sufficient for all our needs. We ask, then, that those seeking our help will recognize, especially with garden-plants, that much labour is sometimes required in tracking down the specimens. Our work would be materially lightened, and its effectiveness considerably increased, if those sending in plants for identification would endeavour to forward as carefully prepared and as full material as possible, showing all parts, especially the foliage and flowering-parts.

Sometimes we receive fragments that look like badly cured tea; sometimes a mass that looks like a poor attempt at ensilage-making. A little care at the sending end would obviate this. We should not then be in the position in which we occasionally find ourselves, of trying to do what is equivalent to determining a particular breed of dog from a couple of hairs plucked from his tail!

NOTE.—Detailed instructions for the packing and forwarding of plant specimens for identification will be found on page 389 of this issue of the *Journal*.—ED.

Sphagnum Moss.—In certain low-lying areas near Lake Rotorna bog develops, favouring the growth of deep sphagnum (bog-moss) beds. Sphagnum is a product noted for its antiseptic, absorbent, and deodorizing properties. In a dried state it is used for various medical purposes, such as dressing wounds. Moist it is utilized for germinating seeds and packing plants. It is also useful in connection with the winter storage of carrots, artichokes, beets, &c. It makes excellent resilient mattresses. Sphagnum is air-dried in considerable quantities by the local Maoris.—B.C.A.

IMPORTATION OF FERTILIZERS IN 1928-29.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1929, are now (by the courtesy of the Comptroller of Customs) available for study, and, with other data, have been compiled for the *Journal* in the accompanying tables.

The importations of basic slag have constituted a record tonnage, nearly double that of any previous year. It is satisfactory to report that no low-grade slag has been noted among the year's shipments.

Bonedust has now almost disappeared from the returns, only 554 tons having been imported during the year. The Stock Act requires all imported animal-manures to be sterilized, under the supervision of a New Zealand Government officer, before shipment to the Dominion. The very small importations from Australia of late years have necessitated the discontinuance of inspection in the Commonwealth, and bonedust is at present imported only from India.

The importations of Nauru and other island phosphates show a steady increase. For the manufacture of superphosphate, phosphate rock has also been received from Morocco during the past two years. The output of superphosphate from the various New Zealand works for the year ended 31st March, 1928, was 275,288 tons, valued at well over a million pounds sterling. The records for the year under review are not yet available, but the indications are that these figures will be exceeded considerably.

A type of phosphate which has hitherto not been imported in any quantity is that recorded in Table 2 as "North African phosphate (other)," and in Table 3 under the heading of phosphate from Belgium. This is a phosphate rock from Tunis containing 28-30 per cent. phosphoric acid. The raw material is exported to Europe, where it is very finely ground, and re-exported. It is offered on the New Zealand market under various proprietary names. By the official citric-acid solubility test this product has a solubility of about 40 per cent. of the total phosphate, as against 80-90 per cent. in basic slag, and 8-10 per cent. in the average ground rock phosphate.

Other fertilizers new to the Dominion, and at present only imported in small quantities, are the German concentrated fertilizers Nitrophoska and Diammonphos (diammonium phosphate), and urea. Nitrophoska is one of the so-called "complete" fertilizers—that is, fertilizers containing the three ingredients nitrogen, phosphoric acid, and potash. It is prepared by melting ammonium nitrate and adding to it potassium chloride and diammonium phosphate. The pulpy mass is well mixed while cooling, and is marketed in a granular condition. This is a highly concentrated preparation which may find useful application in intensive cultivation (market-gardening, &c.). Being soluble in water, it may be used as a liquid manure. Owing to the relatively high proportion of nitrogen and potash in Nitrophoska, it will no doubt best be employed in association with phosphatic fertilizers or on land that is already well supplied with phosphate. Diammonium phosphate is marketed as a finely crystalline preparation containing high percentages of nitrogen and phosphoric acid. Like

Nitrophoska it is offered in various grades, with different ratios of fertilizer ingredients. Urea is a nitrogenous fertilizer containing 46 per cent. of amide (organic) nitrogen. Its relative efficacy in comparison with such fertilizers as nitrate of soda and sulphate of ammonia has not yet been fully determined. These highly concentrated fertilizers should be applied with caution until the amounts of the most useful dressings are ascertained. Too heavy applications may easily cause damage to or loss of the crop.

TABLE I.—SUMMARY OF FERTILIZER IMPORTATIONS, 1928-1929 AND 1927-1928.

Fertilizer.	Quantity.		Declared Value.	
	Year 1928-29.	Year 1927-28.	Year 1928-29.	Year 1927-28.
	Tons	Tons.	£	£
Bonedust	554	725	4,751	6,229
Bone-char .. .. .	..	201	..	662
Basic slag	93,222	48,913	235,285	133,400
Superphosphate	1,037	6,616	2,587	18,304
Nauru and Ocean Islands phosphate	134,323	129,084	175,487	170,349
Island phosphate (other)* ..	43,734	33,199	60,816	50,346
Egyptian phosphate	6,000	6,603	18,975	19,974
Morocco phosphate	14,421	13,389	22,006	19,023
North African phosphate (other) ..	12,499	..	29,856	..
Phosphate (other) .. .. .	..	38	..	219
Guano (nitrogenous) .. .. .	..	35	..	413
Kainit	880	786	2,860	2,164
Muriate of potash	36	23	397	198
Sulphate of potash	1,727	1,502	17,854	14,809
Potash salts (other)	10,780	4,267	50,288	18,913
Sulphate of ammonia	2,268	1,077	28,053	16,239
Nitrate of Soda	1,780	1,021	18,966	11,699
Cyanamide	4	..	30	..
Sulphate of iron	72	131	510	1,332
Fertilizers unspecified	802	84	5,687	1,344
	324,145	247,694	680,410	485,617

* For details see Table 3.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1919-29.

Year ended 31st March,	Bonedust.	Basic Slag	Super-phosphate.	Pacific and Indian Ocean Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1919 ..	3,468	..	21,400	31,351	..	..	..
1920 ..	6,272	2,759	15,842	38,861	15,000	..	..
1921 ..	4,440	10,823	40,731	70,208	10,810	..	..
1922 ..	4,063	13,488	3,140	45,956	..	..	..
1923 ..	2,446	19,641	..	69,591	..	..	..
1924 ..	4,158	39,632	255	76,517	5,996	..	..
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	14,421	12,499

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1928-29 SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY

New Zealand Port of Entry.	Australia.		Chile.	India.	Morocco.	Egypt	Pacific and Indian Oceans Islands.		United Kingdom.		Belgium.		France.	Germany.	United States of America.	
	Sulphate of Ammonia.	Nitrate of Soda.		Bondust.	Phosphate.	Phosphate.	Name of Island	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Phosphate (other).	Basic Slag.	Potash.	Basic Slag.		Potash.
Auckland	399	1,710	475	17,733	11,750		{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	521	4,600	39,924	11,726	923	3,803	6,820	1,905	400
New Plymouth	40	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	10	4,506	17,217	143	100	443	1,691	480	..
Wanganui	60	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	..	..	..	..	..	..	..	..	..
Napier	..	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	189	2,168	6,533	495	80	421	2,950	567	151
Wellington	43	..	..	..	1	3,250	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	77	25	35	..	..	100	695	78	..
Nelson	3	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	..	..	..	..	..	..	..	26	..
Blenheim	..	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	..	..	..	..	..	..	..	..	..
Lyttelton	180	..	25	4,439	1,000	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	22,909	..	..	65	..	295	..	282	10
Timaru	..	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	2,643	..	..	25	..	..	..	100	..
Dunedin	30	..	25	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	10,008	..	100	490	100	285	..	530	62
Invercargill	36	..	..	..	..	..	{ Nauru 72,300 } { Makatea 12,555 } { New Caledonia 2,082 } { Seychelles 4,072 } { Nauru 11,201 } { Walpole 360 } { Makatea 2,658 } { Nauru 16,711 } { Seychelles 711 } { Makatea 2,564 }	2,219	..	50	3,160	55	1,990	1,165	953	..

FLOORING-MATERIALS FOR DAIRY FACTORIES.

F. H. McDOWALL, D.Sc., Dairy Research Institute, Palmerston North, in the
New Zealand Journal of Science and Technology.

THE material used for the floors in New Zealand dairy factories has hitherto for the most part been Portland cement, mixed either with sand and metal as a concrete which is tamped to a fine surface, or as a concrete which is surfaced with a second layer of sand and cement. While floors of this material have given a considerable measure of satisfaction, it cannot be said that they are ideal for the purpose. They are not sufficiently resistant to wear, especially where milk-cans are being moved over them; they are liable to crack; and, more particularly, they are not resistant to the corrosive action of milk and its products. In a large number of cheese-factories in New Zealand recently visited by the author the surface smoothing of the floors had been etched away in many places, leaving a rougher surface, with the stones of the original concrete showing as nodules on the surface.

During a recent tour of Europe and the United States of America the opportunity was taken of making inquiries in an endeavour to find a more satisfactory material for dairy floors. As a net result of these inquiries it may be stated that there is at present no cement available suitable for dairy-floors which will resist completely the corrosive action of milk. In all the countries visited on the Continent of Europe the difficulty is met by the use of tiles laid in a bed of concrete. The joins are filled in with liquid cement, and are grouted every year with the same mixture, as is the custom with tiled whey-tanks in New Zealand. In England the floors in a number of dairies were made of granite chips set in a mixture of ordinary cement. Others were tiled, while the ordinary concrete floor was not uncommon. In America, in cheese and butter factories, the floor was usually of concrete, though tiled floors were observed in a number of places.

The use of steel sheets, or steel networks, for strengthening the surface of the receiving-platform was observed in every country visited. In Holland a special steel "tile" has recently been introduced to take the place of such steel sheets, which have the disadvantage that they become smooth and slippery. The tiles are 8 in. square, and the surface is specially grooved to prevent slipping. A sample of these tiles is available for inspection in the Chemistry Laboratory at the Dairy Research Institute in Palmerston North. The tiles are set in a foundation of concrete. The cost in Holland for such tiles is 15s. per square yard, exclusive of the cost of the concrete foundation and the cost of setting.

The following specifications are supplied for the setting of the tiles: The foundation on which they are laid must be free from vibration, which would gradually dislodge the plate. The floor should be perfectly cleaned from dust. It should then be wiped with a thin liquid cement, which should be allowed to dry a little. A layer 1 in. in thickness of mortar (1 sand, 1 cement) is then applied. The iron tiles should be cleaned dust-free and brushed over with thin liquid cement. They are then filled carefully with mortar so that no air-bubbles are included.

They should then be wiped with a straight-edge so that they are completely full. They are turned over and pushed—without being knocked—into position, as the vibration breaks the contact between the tiles and cement. It is essential to use a fairly wet mortar. When the floor has been laid, a thin layer of cement is placed all over the top to ensure that all the cracks have been filled. This wears off in a short time.

The use of bitumen and asphalt for dairy-floors is restricted by their tendency to soften on heating, and by their solubility in fats. Apart from these disadvantages their acid-resisting properties would render them ideal materials.

Within recent years a special bitumen flooring has been patented, and is now being manufactured in Birmingham under the name of "Prodorite." A specially prepared high-temperature bitumen is used, mixed with fine metal and other materials. The mixture is cast into 12 in. slabs, either plain-surfaced or with a diamond grooving. The slabs are set into a layer of "Prodorite compound" joining-material on a concrete foundation. Since the process is carried out with the compound at a very high temperature, a perfect weld takes place. The resulting floor has an exceedingly hard wearing-surface, and is quite impermeable to water and acid. The compound also makes the necessary provision for expansion and contraction, so that any chance of cracking is eliminated. The floor is ready immediately after laying, as the Prodorite compound hardens completely on cooling.

There seems to be no possible doubt that the flooring will be immune from the corrosive action of acids. The same material is used in the form of tanks for storage of 30 per cent. hydrochloric acid, and the author has seen such a tank in perfect condition after three years' continuous use. It softens on heating, but less easily than the usual bitumen floorings. The makers do not recommend it for temperatures above 160° Fahrenheit. Its resistance to abrasion, on official tests, is twice as great as that of ordinary 2 : 1 sand and cement; and it has the remarkable crushing-strength of 6,000 lb. to the square inch. Its slight solubility in fat may restrict its usefulness for dairy-floors. This matter is now under test at the dairy factory at Massey College, where a portion of the floor of the butter-room has been laid down in Prodorite.

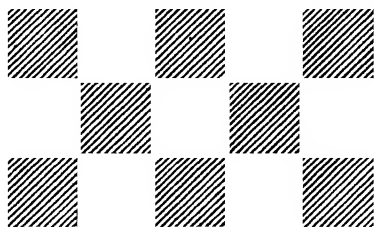
An aluminous cement under the name of "Ciment Fondu" has been extensively used during the last few years in England and on the Continent of Europe for constructional purposes. It possesses the property of setting almost to its final state of hardness within twenty-four hours after being mixed. Measurements have shown that a 4 : 2 : 1 concrete gives a compressive strength of 8,000 lb. per square inch twenty-four hours after gauging. This is a valuable characteristic for dairy-floorings, especially in factories which are in operation throughout the whole year. For emergency purposes in replacing the foundations of separators and other dairy equipment it is particularly useful.

The manufacturers claim that Ciment Fondu is much more resistant than Portland cement to the corrosive action of weak organic acids such as lactic acid, although the claim is not made that it is *acid-proof*. No information was available from dairy factories where the material had been tested under practical conditions for dairy-floors, but the writer is in correspondence with the technical adviser to a large English dairy

company in one of whose factories a trial flooring of this material has been laid down. It is hoped that reports will be received from time to time of the conditions of the floor.

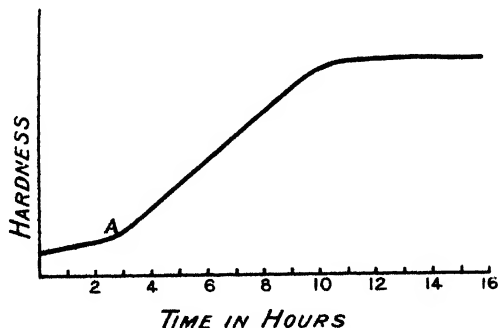
A small area of the flooring has been laid down in the factory at Massey College, but the results of the test may be somewhat doubtful, since the cement appeared to have deteriorated to some extent in transit, and since the workmen had not had sufficient opportunity of gaining experience in the special methods of treatment which it requires.

The most troublesome factor in the use of concrete as a flooring-material is probably the contraction which takes place on setting, resulting often in irregular cracks, disfiguring the surface. To obviate such cracks, floors are often laid down in sections. Ciment Fondu has the same coefficient of contraction as Portland cement, but because of its rapid-hardening properties it can very conveniently be laid down in sections, preferably about 10 ft. square. Alternate sections are laid the



first day, as shown in the diagram. By the following day these are quite hard and fully contracted, and can be used as the working-area for preparing the mixture for the remaining part of the floor. The concrete is filled directly against the edge of the day-old sections. The contraction spaces are thus reduced to a much smaller width than is possible with Portland cement.

The setting-point occurs two to three and a half hours after mixing, the actual time depending on the temperature. It is indicated by a change in the sheen of the surface. The final smoothing of the surface must be carried out at this point (A in the graph), within ten to fifteen minutes, as the change in hardness at the setting-point is extremely rapid.



The concrete should be flooded with water as soon as this can be put on without damaging the surface, in order to reduce contraction, and it should be kept damp with wet sacks for twenty-four hours.

It is even more essential than for Portland cement that the sand used with Ciment Fondu should be perfectly clean.

The cost of Ciment Fondu in England is £7 per ton for 10-ton orders. For export to New Zealand special containers are necessary, which add somewhat to the f.o.b. price. It is possible that there may be some difficulty in importation owing to the tendency of Ciment Fondu, as of Portland cement, to deteriorate slowly with time. This can be tested out only with small trial shipments.

SUMMARY.

There appears to be no true cement at present available suitable for dairy-floors which will resist the corrosive action of milk and whey. The ordinary bituminous floorings are too soft and too soluble in butter-fat. The new bituminous flooring, Prodorite, has a very satisfactory wearing quality, is quite unaffected by the acids of milk, and is more stable both to the softening action of heat and the solvent action of fat. Although it is not completely fat-resistant, it may possibly prove a very useful material for dairy-floors.

Ciment Fondu is a quick-setting aluminous cement which yields a surface available for use twenty-four hours after mixing. It is very suitable for the laying of dairy-floors in sections. The claim is made by the manufacturers that it is more resistant to the action of acids than Portland cement. Some knowledge is still required of its ability to withstand export conditions without any deterioration in quality.

The author will gladly furnish further particulars to any one interested in trying out the floorings herein described.



OFFICIAL GRADING OF NEW ZEALAND EXPORT CHEESE IN WHARF SHED AT AUCKLAND.

[Photo by H. Drake.

SEASONAL NOTES.

THE FARM.

PASTURE MANAGEMENT.

ALL dairying pastures will benefit from thorough chain and tripod harrowing during the winter. Especially so is this the case with pastures on which winter supplementary feeding has been carried out. The organic matter of spread droppings from stock has a wonderfully stimulating effect on both clovers and grasses, and frequent chain and tripod harrowing is necessary for the maintenance of a good even turf. In harrowing old pastures it is not sufficient to spread the droppings only, but the harrows should be heavy enough to slightly tear the surface and allow the aeration of the surface layer of the soil.

The efficiency of nitrogenous fertilizers in promoting an early spring growth of grass was discussed briefly in last month's notes, and farmers with early-calving herds should experiment on a small scale with these fertilizers. It should be remembered that the application of nitrogenous fertilizers to grassland is still in the experimental stage in this country, and that it has not yet been fully determined whether their use is payable. In order to measure the effect of nitrogenous manures in stimulating early spring growth it is necessary to shut up two fields at the same time—one dressed with nitrogen, and the other without the nitrogenous dressing. The turf on these trial fields should be similar, and it should be remembered that nitrogenous fertilizers are most efficient in providing early spring feed on pastures which are composed mainly of perennial rye-grass. Sulphate of ammonia at the rate of 1 cwt. to $1\frac{1}{2}$ cwt per acre, applied in July, is a suitable dressing, and the fertilizer should be put on just before rain. The trial pastures should be fed off with milking-cows when 3 in. to 4 in. high, and care taken not to graze the pastures too hard during the early spring, when the recovery of grass-growth after grazing is normally slow.

Owing to an inadvertent transposition an error occurred in last month's notes in the reference to autumn and early winter production of grass (third paragraph of page 347), whereby July was included in the growing-period. The sentence should read: "On rye-grass pastures the autumn and early winter growing-period extends to the end of June, while July, August, and early September are months of normally poor growth of rye-grass."

' SPRING SOWING OF OATS, WHEAT, AND BARLEY.

Spring-sown oats and wheat are usually sown in August and early September, and barley in September or very early October, so as to avoid the crop being flooded in the early spring. The

nature of the preparatory cultivation for these crops will depend on the class of land and the position they take in a given field rotation.

Land after swedes or soft turnips is usually not clear till the end of July or middle of August, so that the seed-bed for spring cereals after roots must be prepared quickly. Cultivation work should be pushed ahead during all good weather, and the oat crop is usually drilled before a start is made on the preparation of the seed-bed for the barley crop. On light land the roller can be used with advantage in consolidating the seed-bed, but on heavy land its use should be avoided, as it causes the soil to settle down and cake. Spring-sown cereals benefit from a rolling after drilling, but unless the land is light the rolling should be delayed till September or early October, when the land is generally drier. Rolling hardens the surface, breaks the clods, and lessens the amount of dust at harvest-time. In places of low rainfall cereal crops should not be rolled until the crop is 8 in. to 10 in. high, so that moisture will not be lost by evaporation from the bare rolled surface.

Oats do better after grass than any other cereal. On light land the ground should be ploughed in July, rolled on the furrow, disked to a fine seed-bed, and harrowed and rolled before drilling. On heavy land the ploughing can often be best done with the digger plough with a skim coulter and knives attached to the tail-plates, which leaves the land in a fit condition for disking.

Spring cereals often follow a winter fallow, and are usually taken in this place when the land was prepared for autumn and winter cereals and the weather prevented sowing at that time. Barley often does best when taken in this position in the rotation. If the land has settled down badly in the winter, it should be ploughed and worked again before the crop is drilled.

Cereals sown in the spring require a heavier seeding than when sown in the autumn, because less tillering takes place than is the case with autumn-sown crops. Also, with cereals for threshing a light seeding in the spring will give rise to a number of late tillers, and consequently a high proportion of shrivelled grain. The average seeding for spring cereals will be about $2\frac{1}{2}$ bushels to the acre, but the amount will vary from 2 to 3 bushels, depending on the cereal and the local conditions of soil and climate.

All spring-grown cereals should be manured with phosphates. A dressing of 1 cwt. superphosphate in the subhumid, arable farming districts, rising to 2 cwt. to $2\frac{1}{2}$ cwt. in the humid districts, will always give payable increases in yield.

WINTER FEEDING OF LIVE-STOCK.

In feeding dry dairy cows in the winter it should be remembered that normally a cow's fodder consists of green pasture grass with a moisture content of about 70 per cent. Pasture hay contains only some 15 per cent. of water, while roots contain about 90 per cent. If cows in the winter are fed either hay alone or roots alone, digestive troubles are bound to occur. The ration of a cow should be balanced so that it contains both dry and watery foods, the

normal ration being about 14 lb. of hay and 50 lb. to 60 lb. of mangolds. Cows, when dry, are satisfied with bulky foods having a wide nutritive ratio, whereas when in milk they require highly nutritious fodders with a narrow nutritive ratio. Economy of feed is obtained by wintering the cows on coarse fodders such as hay and roots, and saving as much as possible of the winter growth of grass for the spring when the cows calve. When feeding hay and roots the hay should be placed in the field first thing in the morning, and the animals should be allowed to eat part of their hay ration before the roots are thrown out for them. Eating half-frozen roots on an empty stomach is a frequent cause of digestive troubles.

Breeding-ewes on fat-lamb-raising farms should receive careful attention during July to ensure that they get sufficient exercise to keep them in a healthy condition. Ewes on turnips should be moved off at night to a bare grass-paddock, and not put back on the crop until the frost is off the ground. Care should be taken that the ewes are not unduly hurried or crowded when moving from one field to another.

—P. W. Smallfield, *M.Agr.Sc., Fields Superintendent, Auckland.*

THE ORCHARD.

PRUNING OF PIP-FRUITS.

THE practice of pruning as applied to fruit-trees has for its main objects the formation of vigorous, healthy, and mechanically strong trees, shaped in a certain fashion for convenience and economy in orchard-management, to effect a distribution of the fruiting-area over the whole tree, to regulate the size of fruit and improve its quality, and to regulate the crop. It may be assumed that by the practice of thinning out, and the shortening-in of leading shoots, a satisfactorily strong tree has been produced and good growth maintained. When the time arrives for the strong-growing non-bearing tree to produce fruit the treatment then and subsequently must necessarily be carried out with judgment, and must be modified according to the general vigour and of the variety.

Fruitgrowers will readily call to mind orchards and individual trees displaying varying degrees of vegetative vigour and fruitfulness. Attempts have often been made to influence wood-growth and the productiveness of the tree by pruning alone, but the fact that pruning is only one of the factors which modify plant-growth and productiveness has been overlooked. Cultivation and application of fertilizers are factors which must be considered along with pruning in endeavouring to regulate the growth and fruitfulness of an orchard. It should be the aim of the orchardist to maintain his trees in a state of moderate growth with fruitfulness. Very heavy cutting generally results in rank vegetative growth, and in bearing trees a reduction in fruitfulness. Heavy fertilization in addition to this treatment, providing there is sufficient soil moisture, would produce growth still ranker and little or no fruit. This may

be a useful expedient in ultimately bringing into profitable production trees which have suffered through overcropping, disease, &c. No pruning and lack of plant-food tend towards over-production, and if such treatment is continued a condition is soon reached where there would be neither wood nor fruit produced. Bearing in mind the foregoing facts, a pruner should be able to judge in a general way the particular treatment required in dealing with a whole orchard or any portion of it, or with the individual tree.

The lighter the pruning of young trees, consistent with the securing of proper framework, the greater will be their development, and the sooner will profitable crops be produced. The more severely young trees are pruned the longer they remain unfruitful. A period of unfruitfulness must, however, be endured in the building-up of the proper framework. On older trees where bearing is fully established heavier pruning will often be necessary in order to continue regular bearing and to maintain the necessary growth. Supplementary fertilization may be necessary also.

In the promotion of fruitfulness pruning is of value in distributing fruiting-wood uniformly throughout the tree. For fruit-bud formation light is required, and pruning is practically the only means of securing a favourable distribution of light. Regular pruning brings about the best result, as it is only by annual cutting that a constant renewal of fruiting-wood may be secured. Size of fruit is largely influenced by the amount of wood-growth. A tree making satisfactory wood-growth usually produces a crop of larger sizes than those which are unsatisfactory in this respect. Thus system in pruning may provide the means of producing fruit of a size suitable to a particular market.

The principles just outlined apply to both apples and pears. For the correct application of these principles, a brief study of one or two individual varieties may be a help.

Delicious.—This is naturally a strong-growing tree in its earlier stages, and fruitfulness would be delayed by a continuation of severe cutting. Once the foundation of the tree and framework has been secured, a thinning-out and little shortening-in of suitably placed stronger growths may be resorted to—in fact, such growths might be left unpruned. An extension from the terminal bud takes place with a good development of fruit-spurs. On exceptionally strong-growing trees a further extension might be allowed the following year. Cutting back into two- or even three-year-old wood—preferably to a strong shoot—must then be resorted to, otherwise wood-growth may become too weakened. A study of each shoot must determine the subsequent treatment.

Jonathan.—The Jonathan represents a weaker type of tree of early fruiting habit, and every effort should be made to maintain vigour and growth, as its best fruits are borne on two-year-old wood. Leaders should be shortened-in fairly severely and encouraged to grow erect. Laterals retained for fruiting should not be cut back to stubs, but given two-thirds to three-quarters of their length. A lateral cut back slightly would extend from its terminal bud and produce one or two shoots near the terminal, and also develop a

number of fruit-buds which should carry fruit the following year. In the second pruning the lateral could be cut back to a strong shoot, which would have part of its length removed, forcing a growth from the last bud and the development of fruit-buds along its whole length during the next growing-season. The lateral would thus extend, but in a very few years would become very weak unless the treatment was varied. Fruit would become small, buds would weaken, and possibly mildew make headway. A drastic shortening-in of laterals and fruiting-arms to force growth would be required. A certain amount of such hard cutting should be done every year to promote new growth and renew the old fruiting-wood.

Sturmer.—Many varieties of apples tend to overbear, and much hand-thinning is required. Thinning the shoots and branches, and also thinning the spurs, renewing the much-branched ones by removing the older parts and saving the newer, will tend to invigorate the tree and reduce the crop somewhat. This will encourage annual bearing and reduce the amount of hand-thinning necessary. Such treatment is often found necessary on a free-spurring variety such as *Sturmer*

—*N. J. Adamson, Orchard Instructor, Hastings.*

Citrus-culture.

Poorman oranges are a crop which to harvest to best advantage requires several pickings. No fruits should be picked unless the green colour has changed to a shade of yellow, otherwise a pronounced wilting will take place if their disposal is delayed even for a short period. The fruits should be very carefully handled, as skin-punctures or stem-ruptures rapidly lead to moulds and decay. Where it is intended that they be shipped long distances fruits should be allowed to remain a few days in open cases for preliminary evaporation. Fruits close-packed direct from the tree are prone to sweat, and under very bad conditions may discolour and decay set in. When fruits are intended for preserving they should be picked as soon as size and colour are attained. When the larger sizes are intended for sale as grape-fruits they can with advantage be allowed to hang longer, as quality is more readily attained on the tree than in storage.

Lemons should be picked as they attain correct size and change of colour, and then put away for curing and storage. Stored lemons should be checked over frequently at this season, as decays are more prevalent than with fruits picked in dryer seasons.

Where the recommended precautions have been taken to safeguard against brown-rot, little infection should be expected, but it will be as well to apply bordeaux, 4-4-40, during a spell of fine weather. Should brown-rot be present every care should be taken to collect and destroy diseased fruits.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

PREPARING FOR NEXT YEAR'S WINTER LAYERS.

It is now recognized as an established fact that if poultry-keeping is to prove a really profitable undertaking eggs must be produced in good numbers in other than the spring and summer months. The fact that fresh eggs during recent months have commanded more than double the price of those produced during the flush season of supply goes to indicate how many producers there are out of the 154,000 poultry-keepers in the Dominion who fail to secure eggs when high prices rule. Obviously there can be no comparison made as regards profit between a bird laying the bulk of her eggs during the dear season and one producing her main yield in the cheap season, when almost any sort of fowl will lay. The poultry-keeper who secures a good supply of eggs when prices are high is usually termed lucky by those who fail. There is no luck about it, for it is nothing other than the result of common-sense management combined with strict attention to details. Those poultry-keepers who have failed to secure high-priced eggs in the past, and who desire to secure them during the next dear season, must prepare the way for them now. Pullets must be depended upon, and the early pullet must be hatched out at a time other than the natural breeding-season for bird-life; further, it must be well fed and managed throughout all stages of its development. The breeding-birds should be mated at once, if not already done, in order that fertile eggs may be available for hatching purposes by the beginning of July. If the earliest pullets are hatched during July these will commence to lay when the majority of the adult stock are terminating their laying season, and at a time when egg-prices commence to rise.

It may be said, and rightly so, that the bulk of the July-hatched pullets will moult in the late autumn, and that there will be a loss of winter eggs. This is quite possible, but on well-managed plants there should be later-hatched pullets specially bred for laying during the cold months of the year. In any case all the early-hatched birds will not moult and cease to lay at exactly the same time. Obviously some birds will moult earlier than others, so that when the latter are moulting the former will have renewed their feathers and be ready to resume laying. Another advantage in having such stock on the plant is that owing to their moulting during the late autumn or early winter they can usually be depended upon to lay well into the autumn or early winter during the following year, when the price of eggs is on the up grade.

The writer quite realizes that on the average plant adult birds are seldom laying at this period of the year, and that in order to secure early chicks the poultry-keeper is of necessity forced to use pullet eggs for incubation. Here it may be mentioned that the principle of breeding from pullets for the maintenance of a heavy-laying flock—in other words, as a foundation stock—is not recommended; but in the case of breeding, especially for the production

of autumn eggs, an exception must be made. In any case, the pullets bred for this purpose need not necessarily be used for future breeding purposes. Experience goes to show that if pullets are well developed, have been bred from an adult hen, and commenced to lay early in the year without being forced, most desirable progeny may be produced by mating them with a second-year male. The great danger lies in using in the breeding-pens pullets which have been bred from pullets generation after generation, as such usually results in the production of weak-constituted stock and layers of undersized eggs. Especially is this the case when the pullets have been mated with cockerels bred in the same way.

These remarks refer only to early hatching for the production of pullets for autumn and early winter laying; August and September are equally favoured as being the best months for hatching out the main flock of layers.

BREEDING-POINTS.

In choosing birds for the breeding-pen, whether pullets or hen, one should aim for birds of uniform laying type, combined with points indicating good health and constitutional vigour. The latter quality is usually indicated by a prominent, fiery eye, bright-red comb and face, close and thick feathering, short shanks set well apart, well-developed crop, and a general active and business-like appearance. The chief points indicating egg-capacity are an oblong body, width across the back, depth and fullness of abdomen, together with fine texture throughout.

In the mating of stock the male bird has an important bearing; he is more than half the stock. He should, above all things, possess the signs indicating strong constitutional vigour as referred to in the selection of females. Further, he should be the son of a healthy mother with a record of egg-laying performance behind her. He should also possess strong masculine characteristics, as indicated by good chest-development, good width and depth of body, stout legs, with flat bone (not round), a stout well-curved beak, and generally a bold carriage. It should always be remembered that the feminine-looking male or the masculine females should never be bred from.

With regard to size, whether in male or female, one should never breed from diminutive specimens of their breed. The small ones will come soon enough even when good-bodied birds are mated. If a desirable size is to be maintained, all breeding stock should conform to the weight clauses as contained in the Utility-poultry Standards for the respective breeds. Copies of this publication are obtainable from the Department of Agriculture at a cost of 3s each, postage free.

The number of hens to mate with one male depends entirely on the local conditions affecting the stock and plant. Where a good range is provided a high proportion of fertile eggs may be obtained by using one male to twenty or more females; but when the birds are confined in a house or run the number must be considerably reduced if good results are to be secured. No hard-and-fast-rule, however, can be laid down in this respect. The

poultry-keeper must use his own discretion, and be guided by the number of fertile eggs produced. In a general way, when the birds are confined, and during the early season, six to eight hens of the heavier type will usually prove sufficient for one male. If the male is a vigorous one this number may be increased as the season advances. With the lighter breeds, such as Leghorns and Minorcas, eight females may be mated to one male, and in the spring months up to twelve or even fifteen.

For the management of the breeding-pen readers cannot do better than follow the advice published in these notes in the last April issue of the *Journal*.

—F. C. Brown, *Chief Poultry Instructor, Wellington.*

THE APIARY.

THE WINTER SEASON.

DURING the ensuing months there will be little to do in actual bee work. Manipulation of the colonies must cease on account of the cold weather, and other work of this nature must be set aside until the spring. The chief thing is to see that none of the colonies starve, as losses of this kind, when made in the winter, spring, or early summer, detract considerably from the following honey crop. To secure an increase in colonies without material loss in strength in the individual hives requires a considerable amount of time and labour, and should a bad spring be experienced expense will also be incurred. It pays, therefore, to look well after colonies already formed, and from 30 lb. to 40 lb. of sealed stores should have been left at the disposal of each colony at the commencement of winter thus assuring strength in the spring. Do not at any time disturb the cluster of bees.

Should it be found necessary to give additional feed, this should be placed alongside the bees inside the hive. A comb of clean sealed honey or a cake of candy is best. Do not feed honey from a doubtful source, as it may contain the spores of foul-brood. Some beekeepers prefer to feed sugar-syrup in the spring, and so stimulate the bees to start brood-rearing earlier than they otherwise would do. This is sometimes advantageous and even necessary, but at the same time a colony will require less attention and do equally well if left with plenty of winter stores.

It is a good plan to remove damp mats from the top of the frames and replace with dry ones. Damp mats also indicate that the cover or roof requires repairing, and this should be attended to.

Spare supers that were left on the hives should now be removed, where it can be done without unduly disturbing the cluster, and the bees confined to the brood-chamber. In the northern parts of the Dominion breeding will start in colonies of normal strength at the latter end of July, and every effort should

be made to make the bees snug, so as to promote breeding. Where the bees have taken to the supers entirely the bottom story is the one to be removed.

During the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies are by this means reduced to the verge of starvation by the spring. It is the work of only a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble the entrances should be contracted.

A periodical examination should be made of all extracting-combs stored in the honey-house, for the purpose of seeing that they are not attacked by moths. Where the combs have been attacked they should be fumigated. For this purpose place the combs in supers piled one above the other, and put a saucer-full of carbon bisulphide on the top. The fumes, being heavier than air, will sink slowly to the bottom, destroying all moths and eggs with which they come in contact. Care should be taken not to inhale any of the fumes, as they are poisonous. The gas being highly inflammable, it should not be brought into contact with a naked light.

PERMANENT SHELTER.

This is the season when it is most evident to the observant apiarist that bees require plenty of shelter from high winds. Where necessary, the planting of shelter-hedges to protect the apiary should now be taken in hand. Experience proves that bees in sheltered positions thrive far better than those in exposed situations. If the hives are protected, the bees can take exercise every sunny day during the winter months, and this exercise is essential to their well-being, as it is only in flight that bees can properly rid themselves of their excreta. Where sufficient shelter is not provided, numbers of bees are lost through being beaten down by cold winds and rendered unable to return to their hives. Apart from the benefit to the bees, the apiarist will find his work much more congenial when he himself is protected by permanent shelter. Shelter-hedges should be grown to a height of about 8 ft. and no higher, and this will afford ample shelter for a large apiary. Of the many quick-growing hedges, giant privet and tagasaste ("tree lucerne") are perhaps the best. These plants have been tested throughout the Dominion with good results. In the South yellow barberry holds pride of place as a hedge for apiaries, because, in addition to affording ample shelter, it yields an abundance of pollen and nectar in the early spring. Whatever species are used, planting should be done with the idea of forming a thick hedge, and not to form a plantation. If tagasaste or giant privet are planted they should be well protected from stock.

LIQUEFYING GRANULATED HONEY.

Many of the public still have doubts regarding the purity of honey when it is granulated—that is, when it is in the solid crystallized form. Consumers have speculated on the point, some declaring that sugar had been mixed with the honey to bring it to

that form. Such, however, is not the case, as practically all honeys throughout the Dominion granulate, and it is usually found that when foreign matter is introduced the granulation process is greatly retarded or stopped altogether. Thus, if honey is in a granulated form, this condition may be regarded by the layman as one of the best indications of its purity.

It is frequently desired that honey be consumed in liquid form, and in this case the glass jar or tin containing the granulated article should be placed in a vessel of water at a temperature of about 140° F. This heat should not be exceeded, as otherwise the aroma and flavour may be seriously affected or destroyed. Sometimes, according to the solidity of the granulation, the honey may take as long as three hours to properly liquefy. It is advisable to place something under the tin or jar to keep it from direct contact with the bottom of the heating-vessel.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

STARTING THE NEW TOBACCO CROP.

IN most tobacco-growing districts it is now becoming customary to sow the seed towards the end of July in pans or boxes, and to raise the plants in a glasshouse. They are then ready for pricking out into seedling beds about the end of August or the beginning of September. For this purpose it is important to obtain seeds of a suitable variety and high strain. Some experimenting has been done in many localities, and growers will now have a better idea of the variety suited to their soil and purpose, but the seeds should be obtained from a specialist who has a reputation for that work, so that the type may be uniform and of a high standard. Annual plants of this class very quickly deteriorate in type unless the greatest care and skill is exercised in growing the seed.

Good well-rotted turf is suitable for the seed-boxes, and it will be all the better if it is sterilized. It may be put through a $\frac{1}{4}$ in. sieve, and a layer of the more fibrous material placed on the bottom. The boxes should then be filled within an inch or so of the top with fine soil, and pressed down firmly with a piece of board. If necessary, water the soil by immersing the box in slightly tepid water, and, after draining well, sow the seed thinly and press it into the soil. A long 0.22 empty cartridge-case, when filled, contains about 2,000 seeds, sufficient for the ordinary seed-box measuring 18 in. by 12 in. It should produce 1,500 seedlings, and four or five of these seed-boxes should be grown to plant an acre in the field. A sheet of glass placed over each box will prevent the soil drying out and assist germination. Dry the glass by turning it over daily, and remove it as soon as the seeds germinate. The temperature may go up to 80° F. during the day with the ventilators open, but it should not fall below 45° at night with the house closed up.

Stored leaf in bulk should be examined occasionally to see that all is well. If large bulks are built in good well-ceiled rooms, on

good floors well up off the ground, there is not likely to be any unsatisfactory development; but if the leaf is exposed to changes of temperature and a humid atmosphere great care is needed. Small quantities are best held in a good packing-case.

TOMATOES AND SMALL FRUITS.

Seedling tomato-plants under glass will now be ready for pricking-out, and this should be done with care to avoid chilling them. Once the plants are established, however, they should be grown hardily, and given air in bright warm weather. The danger from frost is considerable in some localities, and in extreme cases one or two heaters should be available in case exceptional need should arise. One or two growers have electric current laid on, which enables them to plug in a few heaters when needed. This is quite effective, but is hardly warranted where supplies of stable manure are available for a good hotbed.

The pruning of bush fruits should now be completed, and the bushes should be given such spray treatment as may be necessary. In any case a bordeaux spray at winter strength should be applied just before growth commences, owing to the prevalence of leaf-spot, rust, and other fungi. In the case of the raspberry crop, arsenate of lead may be included with the bordeaux to prevent the attack of insects in the buds. Where scale insects are troublesome, an oil spray at 1-12 or 1-15 will be effectual. For strawberries an application of bordeaux, 4-4-40, or lime-sulphur, 1-80, is usually indispensable to preserve the plants from the attack of the leaf-spot fungus. The foliage should be well covered, and the application repeated as necessary, so that the plants are protected up to the time the fruit commences to set.

Too often the bush-fruit section is expected to yield a good crop with very little spraying and less manure, but the quantity and quality of the berries will be low unless the bushes receive liberal treatment in the way of manuring. Most crops of this class will be greatly benefited if they are now given a dressing of suitable fertilizers. What that should be depends on past practice and experience, but in their absence the following may be applied: 2 oz. superphosphate, 1 oz. sulphate of potash, and 1 oz. sulphate of ammonia per square yard. This should be broadcast and lightly worked in, taking care not to disturb the fibrous roots which lie close to the surface.

THE MARKET GARDEN.

Savoy cabbage, celery, leeks, and roots are now being harvested and placed on the market, with cauliflower, broccoli, and spring cabbage coming to maturity.

Asparagus and rhubarb beds will shortly start into growth, and the busy spring-time operations will commence with plantings of autumn-sown onions, lettuce, cabbage, and cauliflower; also the sowing of lettuce, radish, spinach, onions, and broad beans, as soon as the soil is in condition. New beds of rhubarb may also be made, and in warm districts early potatoes and peas may be planted and sown. The preparation of the land for these and later

crops should now be completed as soon as possible, incorporating a good dressing of well-prepared organic manures for such crops as cabbage, cauliflower, salads, peas, and rhubarb. Complete the preparation of the land by hoeing in fine weather to destroy seedling weeds, and obtain a fine tilth, working in such fertilizers as may be required shortly before sowing.

Seed potatoes should now be stored in a light cool place that is not too dry. They may be spread in trays, or, as is more general, stacked in well-ventilated boxes in a suitable place. Under such conditions the growth will be short and sturdy, and the tubers will not shrivel.

Broccoli and spring cabbage planted in the autumn and now maturing will often be benefited by a small dressing of nitrate of soda or sulphate of ammonia to encourage growth.

Asparagus-beds should now be manured; 2 oz. superphosphate, 2 oz. nitrate of soda, and 1 oz. sulphate of potash, per square yard, will be a useful dressing for those in doubt on the matter. Most crops of rhubarb would derive great benefit from a similar application made now.

THE HOME GARDEN.

Where hard-wooded plants are to be grown, they should be planted now or as soon as possible when the land is sufficiently dry. Fairly large groups are more effective than single plants, and where evergreens are required for a background it should be remembered that our native trees are unexcelled for that purpose in most districts. After planting firmly a little shortening and thinning of the growth is generally advisable, to counterbalance the unavoidable pruning of the roots in transplanting. Hardy herbaceous plants may also be planted, and the comparatively large grouping arrangement is most effective with this class also. Most kinds of herbaceous plants require a rich soil, and a generous quantity of organic manures should be trenched in. In the absence of well-rotted stable manure a liberal dressing of blood-and-bone fertilizer, 4 oz. to the square yard, should be turned well under.

Worn places in lawns may now be patched with turf. As far as possible it should be of similar grasses, and neatly done to leave a smooth surface.

—W. C. Hyde, *Horticulturist*, Wellington.

Noxious Weeds Orders.—The Pohangina County Council has declared hemlock and burdock to be noxious weeds within that county. The Mangaweka Town District and Hunterville Town District have likewise declared hemlock as regards their respective territories.

Wool Statistics.—The following figures, from a compilation by the New Zealand Wool Committee, refer to the local wool sales for the period from November to the end of March in the two last years respectively: Season 1927-28—Number of bales sold, 514,133; average prize realized per bale, £24 5s.; average price per pound, 16-89d.; total realization, £12,468,097. Season 1928-29—Number of bales, 538,493; average per bale, £21 10s. 11½d.; average per pound, 15-06d.; total, £11,603,428.

LIVE-STOCK PRODUCTION IN NEW ZEALAND.

REVIEW OF PERIOD 1901-2 TO 1926-27, BASED ON STANDARD VALUES AND UNITS.

E. J. FAWCETT, M.A., Farm Economist, and W. N. PARON, Farm Economics Section, Fields Division, Department of Agriculture, in the "New Zealand Official Year-book," 1929

FOR the purposes of a study of this nature, where the aim is to obtain a general index number or its equivalent depicting combined production, quantities alone are useless, since various commodities are expressed in different units. A combined production figure is arrived at by making use of arbitrary standard values and equivalents. After applying these to the quantities for the various products, values for the latter are obtained. These combined give total production in terms of value. As this aggregate value is derived from flat-rate prices throughout the range of the period studied, they reflect quantity rather than value of production. Index numbers as commonly used have generally a base or par value of 100 or 1,000. In this review it was considered advisable to adopt a unit based on equivalents. This method has the advantage of greater utility, as it may be very simply converted from units to standard value, quantities, or actual values. The unit adopted was one of 10,000, and, as will be seen from the following tabulation, it possesses all the qualities claimed.

STANDARD VALUES USED: GRASSLAND PRODUCTS.

Live animals—	£	s.	d.	By-products—continued.	£	s.	d.
Cattle (per head) ..	10	0	0	Sausage-casings (cwt.) ..	20	0	0
Horses (per head) ..	30	0	0	Sheep-skins (each) ..	0	4	9
Pigs (per head) ..	2	0	0	Tallow (ton) ..	20	0	0
Sheep (per head) ..	2	0	0	Meats—			
By-products—				Calves (each) ..	0	10	0
Calf-skins (each) ..	0	2	6	Cattle (per carcass) ..	5	0	0
Hair (cwt.) ..	5	0	0	Lamb (per carcass) ..	1	0	0
Hides (each) ..	1	0	0	Pigs (per carcass) ..	2	10	0
Horns (ton) ..	15	0	0	Sheep (per carcass) ..	1	0	0
Kidneys (cwt.) ..	2	0	0	Wool (lb.) ..	0	1	0
Lard (ton) ..	25	0	0	Butterfat (lb.) ..	0	1	3

UNIT VALUE OF GRASSLAND PRODUCTS.

(Unit of production -- £10,000 at standard values.)

2,000 cattle carcasses	= 1 unit.	5,000 live sheep	= 1 unit.
200,000 lb. wool	= 1 "	80,000 calf-skins	= 1 "
160,000 lb. butterfat	= 1 "	2,000 cwt. hair	= 1 "
10,000 lamb carcasses	= 1 "	10,000 hides	= 1 "
10,000 mutton carcasses	= 1 "	666-6 tons horns	= 1 "
4,000 pig carcasses	= 1 "	5,000 cwt. kidneys	= 1 "
20,000 calf carcasses	= 1 "	400 tons lard	= 1 "
1,000 live cattle	= 1 "	500 cwt. sausage-casings	= 1 "
333-3 live horses	= 1 "	42,106 sheep-skins	= 1 "
5,000 live pigs	= 1 "	500 tons tallow	= 1 "

NOTES.—1. To find total returns for any item at the standard value quoted, add four noughts (0000) to production units given in tables.

2. To find quantity of any commodity produced, multiply the units produced by the number of such commodity which represent a unit.

3. To find sale values for any commodity, add or subtract the difference between prices realized and the standard values used.

The standard values quoted for the various live-stock products are based on what is considered to be approximately an average value over

the period under review. For convenience in calculation, these values in the majority of cases have been taken in whole numbers or simple fractions thereof. In the live-animal section values allowed for animals exported alive are higher than for carcasses, owing to a proportion of the former being pedigree animals. The values for meats have been decided upon after careful thought. The figure for sheep and lamb carcasses gives a decided advantage to the earlier years if interpreted in money, as prices then were low. On the basis of units of production, however, this does not affect the position. Sheep-skins at 4s 9d. each is an average value for such, with and without wool.

The coefficients given have been derived from the standard values quoted, £10,000 being the value of one unit of production.

Table 1 depicts primary live-stock production on the unit basis. Values for sheep, lambs, pigs, cattle, and calves are based on total slaughterings. The Live-stock Division of the Department of Agriculture compiles and publishes each year figures of slaughterings at abattoirs, meat-export slaughterhouses, bacon-factories, and ordinary slaughterhouses for years ending 31st March. The Census and Statistics Office compiles and publishes slaughterings of stock on farms each year for twelve months ending 31st January. As the latter do not vary greatly from year to year, they have been added to the former to give the total for the season. The figures for total wool-production have been obtained by adding shlipd wool to the wool-clip of the season, and are based partly on actual and partly on estimated figures. Wool on skins exported is allowed for under skins, with and without wool (see by-products). Total butterfat is comprised of partly actual and partly estimated figures, and indicates total production at the milk-pail, accounting for all losses, &c., from this stage forward. In the

TABLE 1.—PRODUCTION ON UNIT BASIS: MAIN PRODUCTS.

Season.	Mutton	Lamb.	Wool.	Total Sheep Industry.	Butter- fat.	Pigs.	Beef.	Calves	Total Units.
1901-2 ..	248	167	813	1,228	303	4	40	..	1,575
1902-3 ..	373	231	784	1,388	331	6	50	..	1,775
1903-4 ..	345	234	751	1,330	381	8	49	..	1,768
1904-5 ..	267	210	760	1,237	398	17	55	1	1,708
1905-6 ..	234	260	798	1,292	404	18	59	1	1,774
1906-7 ..	318	300	860	1,478	424	25	87	1	2,015
1907-8 ..	283	292	882	1,457	432	27	101	1	2,018
1908-9 ..	328	339	924	1,591	462	35	137	1	2,226
1909-10 ..	314	373	961	1,648	541	28	150	1	2,368
1910-11 ..	382	410	945	1,737	552	41	143	1	2,474
1911-12 ..	364	325	955	1,644	574	58	119	1	2,396
1912-13 ..	376	356	949	1,681	639	48	130	1	2,499
1913-14 ..	447	439	996	1,882	686	48	150	1	2,767
1914-15 ..	445	453	1,017	1,915	699	60	174	2	2,850
1915-16 ..	447	415	1,002	1,864	753	55	185	2	2,859
1916-17 ..	420	348	988	1,756	797	62	195	1	2,811
1917-18 ..	423	274	979	1,676	755	55	172	1	2,659
1918-19 ..	500	301	1,115	1,916	778	51	179	1	2,925
1919-20 ..	618	334	1,015	1,967	849	59	209	2	3,086
1920-21 ..	532	362	988	1,882	969	53	185	2	3,091
1921-22 ..	490	515	1,091	2,096	1,243	72	134	2	3,547
1922-23 ..	358	460	952	1,770	1,410	70	180	2	3,432
1923-24 ..	336	527	961	1,824	1,428	80	212	3	3,547
1924-25 ..	391	497	949	1,837	1,506	99	250	4	3,696
1925-26 ..	357	521	1,016	1,894	1,462	101	234	4	3,695
1926-27 ..	381	554	1,068	2,003	1,617	111	207	5	3,943

TABLE 2.—EXPORTS ON UNIT BASIS OF ANIMAL BY-PRODUCTS AND LIVE ANIMALS.

Season.	Skins (Sheep and Lamb).	Sausage- casings	Kidneys.	Tallow.	Calf- skins.	Hides.	Hair, Horns, Lard.	Horses, Sheep, Cattle, Pigs (Live Animals).	Total.
1901-2 ..	145	27	1	42	0	5	5	17	242
1902-3 ..	166	29	2	40	0	5	1	6	249
1903-4 ..	141	25	1	32	0	5	1	3	208
1904-5 ..	111	22	1	22	0	10	1	4	181
1905-6 ..	125	27	2	38	1	13	1	5	212
1906-7 ..	160	31	2	41	2	18	1	5	260
1907-8 ..	145	28	1	37	1	18	3	3	236
1908-9 ..	167	32	1	28	2	19	5	7	261
1909-10 ..	177	45	2	52	1	18	11	17	323
1910-11 ..	174	44	1	41	2	13	9	19	303
1911-12 ..	181	63	1	47	2	15	8	8	325
1912-13 ..	187	62	1	45	2	17	6	5	325
1913-14 ..	196	81	2	49	2	22	7	11	370
1914-15 ..	218	89	2	47	3	27	8	19	413
1915-16 ..	201	45	2	45	3	30	5	9	340
1916-17 ..	163	36	2	25	1	18	7	2	254
1917-18 ..	219	40	1	33	1	21	4	2	321
1918-19 ..	213	46	3	94	1	32	7	1	397
1919-20 ..	231	50	2	54	3	29	3	2	374
1920-21 ..	209	45	18	55	6	33	1	2	369
1921-22 ..	242	45	2	45	6	22	2	2	366
1922-23 ..	193	43	1	50	8	34	3	6	338
1923-24 ..	208	50	1	48	9	47	5	2	370
1924-25 ..	209	56	1	50	9	50	4	2	381
1925-26 ..	216	63	1	42	9	45	7	2	385
1926-27 ..	230	62	1	48	10	40	5	2	398

absence of records of such items as milk and cream consumption *per capita*, whole-milk fed to calves, losses, &c., estimates are necessary in order to fill the blanks. This work was gone into very thoroughly, and may be accepted as reliable.

The products included in Table 1 may be termed primary grassland products. What are termed the by-products of these are given in Table 2. All figures in this table are exports for years ended 31st December. Little, if any, of the following season's production is likely to be included in these totals, because of the lag between production and export. Live animals exported may not be truly a by-product, but this item is of such minor importance that it was thought best to include it here. The total of these is given on the extreme right.

For convenience, Table 3 sets out total live-stock products divided into its main sections. Table 4 furnishes the reader with the numbers of dairy cows, total cattle, sheep and lambs, breeding-ewes, area occupied, and area of total grassland. All but the last are official figures of the Census and Statistics Office, with the exception of those years marked. For these years enumerations were not made, and the blanks for dairy cows and total cattle were completed on the geometric mean, and those for area occupied on the arithmetic mean. Total grassland is comprised of sown, native, and tussock grasses. A considerable amount of estimation was demanded to procure this figure, as beyond 1914-15 tussock- and native-grass areas were included with total unproductive area. The estimations were "smoothed," giving a "straight-line trend" throughout the entire period, instead of showing part actual and part estimated figures. It is considered that this estimation closely follows the actual position. Table 5 should be self-explanatory.

Sections (a) and (d) are based on all dairy cows in milk and dry. "Smoothed products per acre of total grassland" needs some explanation. Total live-stock products as given in Table 3 were smoothed on the straight-line secular trend, and these divided by the estimated figures for total grassland (which also are on a straight-line secular trend). "Percentage of area occupied which is unproductive" has been arrived at by expressing the difference between the straight-line figures for total grassland and total area occupied as a percentage of total area occupied. "Production per sheep as at 30th April" is obtained by dividing total sheep-industry figures (*i.e.*, lamb, mutton, and wool) by the number of sheep and lambs as at 30th April. This was considered the best base available for the purpose. Sections (d) and (f) are presented in graphical form in Diagrams 3 and 4 respectively.

It will be seen from the foregoing that we have available total live-stock production, numbers of stock, and area of grassland. From these it is possible to consider how unit production has fluctuated. Lamb, mutton, wool, butterfat, beef, and calf figures are selected as being directly associable to area of grassland. The pig industry has been excluded not because it is not a primary grassland product, but more because this industry has not been so fully exploited in early years as in the case of the others. By dividing the total of production for these sections by total area in grass we have figures for production per acre. The area devoted to crops for stock-feeding is difficult to handle in this question, and has been excluded.

TABLE 3.—TOTALS OF PRODUCTION FROM PASTURES ON UNIT BASIS.

Season.	Sheep-products	Dairy-products.	Pigs, Cattle, Calves.	Live-stock By-products and Live Animals.	Total Live-stock Products
1901-2	1,228	303	44	242	1,817
1902-3	1,388	331	56	240	2,024
1903-4	1,330	381	57	208	1,976
1904-5	1,237	398	73	181	1,889
1905-6	1,292	404	78	212	1,986
1906-7	1,478	424	113	260	2,275
1907-8	1,457	432	120	236	2,254
1908-9	1,591	462	173	261	2,487
1909-10	1,648	541	179	323	2,691
1910-11	1,737	552	185	303	2,777
1911-12	1,644	574	178	325	2,721
1912-13	1,681	639	179	325	2,824
1913-14	1,882	686	199	370	3,137
1914-15	1,915	699	236	413	3,263
1915-16	1,864	753	242	340	3,199
1916-17	1,756	797	258	254	3,065
1917-18	1,676	755	228	321	2,980
1918-19	1,916	778	231	397	3,322
1919-20	1,967	849	270	374	3,460
1920-21	1,882	969	240	369	3,460
1921-22	2,096	1,243	208	366	3,913
1922-23	1,770	1,410	252	338	3,770
1923-24	1,824	1,428	295	370	3,917
1924-25	1,837	1,506	353	381	4,077
1925-26	1,894	1,462	339	385	4,080
1926-27	2,003	1,617	323	398	4,341

NOTE.—Figures for 1927-28 now available: Sheep-products, 2,097; dairy-products, 1,651; pigs, cattle, calves, 361; live-stock by-products and live animals, 418; total live-stock products, 4,527 units.

TABLE 4.—TOTALS OF STOCK, AREAS OCCUPIED, AND AREA IN GRASS.

Season.	Total Cows in Milk or Dry at 31st January.	Total Cattle at 31st January.	Total Sheep and Lambs at 30th April.	Breeding- ewes at 30th April (Flock and Stud).	Total Area occupied.	Total Area in Grass ("Smoothed" Estimate): Sown, Native and Tussock.
					Acres.	Acres.
1901-2 ..	381,492	1,361,784	20,342,727	9,610,149	35,507,889	28,412,100
1902-3 ..	428,773	1,460,663	18,954,553	9,071,751	35,887,447	28,545,500
1903-4 ..	468,125	1,593,647	18,280,806	9,222,448	36,476,481	28,678,900
1904-5 ..	498,241	1,736,850	19,130,875	10,079,184	36,511,154	28,812,300
1905-6 ..	517,720	1,810,936	20,108,471	10,479,187	37,167,460	28,945,700
1906-7 ..	543,927	1,851,750	20,983,772	10,736,846	37,408,473	29,079,100
1907-8 ..	541,363	1,816,299	22,449,053	11,244,041	37,564,288	29,212,500
1908-9 ..	536,629	1,773,326	23,480,707	12,370,346	38,204,349	29,345,900
1909-10 ..	583,163*	1,892,729*	24,269,620	12,515,380	39,221,237*	29,479,300
1910-11 ..	633,733	2,020,171	23,996,126	12,324,463	40,238,126	29,612,700
1911-12 ..	655,603*	2,094,033*	23,750,153	12,277,029	40,467,709*	29,746,100
1912-13 ..	678,021*	2,170,595*	24,191,810	12,521,036	40,697,292*	29,879,500
1913-14 ..	701,312*	2,249,956*	24,798,763	12,920,176	40,926,875*	30,012,900
1914-15 ..	725,403*	2,332,219*	24,901,421	12,615,341	41,156,458*	30,146,300
1915-16 ..	750,323	2,417,491	24,788,150	12,892,767	41,386,040	30,279,700
1916-17 ..	777,439	2,575,230	25,270,386	13,260,169	42,744,719	30,413,100
1917-18 ..	793,212	2,869,465	26,538,302	13,022,034	43,212,079	30,546,900
1918-19 ..	826,135	3,035,478	25,828,554	12,341,900	43,342,706	30,679,500
1919-20 ..	903,454	3,101,945	23,919,970	11,569,675	43,473,079	30,813,300
1920-21 ..	1,004,666	3,139,223	23,285,031	12,147,788	43,546,757	30,946,700
1921-22 ..	1,137,055	3,323,223	22,222,259	12,496,054	43,528,337	31,080,100
1922-23 ..	1,248,643	3,480,694	23,081,439	13,063,003	43,653,163	31,213,500
1923-24 ..	1,312,588	3,563,497	23,775,776	13,076,094	43,572,564	31,346,900
1924-25 ..	1,323,432	3,503,744	24,547,955	13,715,223	43,632,372	31,480,300
1925-26 ..	1,303,856	3,452,486	24,904,993	13,948,252	43,606,829	31,613,700
1926-27 ..	1,303,225	3,257,729	25,649,016	14,831,730	43,587,698	31,747,100

* Interpolated.

At the same time, production per acre has been considerably affected by feed crops. It has been assumed that each cattle beast is equivalent to six sheep in grass-consumption. All cattle have been converted to sheep units of stock on this basis, all dairy and beef animals being included, whether mature, two-year-olds, yearlings, or calves. The conversion figure adopted is considered a reasonable one in the light of information available. However, were the value taken as five or seven, it would not materially affect the trends established from the other. By dividing total production by the total sheep units of stock we obtain a figure of production per animal, assuming all stock to be sheep. Sheep units of stock carried per acre of all grassland is derived by dividing total sheep units of stock by total acres of all grassland. We now have figures for production per acre and per head of stock, and stock carried per acre. These three factors are the principal ones to be studied in considering production. In Diagram 1, curves have been given on a common scale to facilitate comparison, and depict (1) total production of lamb, mutton, wool, butterfat, beef, and calf; (2) production of lamb, mutton, wool, butterfat, beef, and calf per acre of all grassland; (3) total sheep units of stock carried, (4) sheep units of stock carried per acre of all grassland; (5) production of lamb, mutton, wool, butterfat, beef, and calf per sheep unit of stock carried; and (6) total grassland (*i.e.*, sown, native, and tussock grasses). The whole lines give the actual points for the various years, while the broken lines indicate the straight-line secular trends. No actual figures have been quoted for all grassland, since this could only be done from 1915-16 onwards. Secular trends have been obtained from the range 1901-2 to 1925-26 by taking

moments about the mid-point — viz., 1913-14 — allotting the arithmetic mean to this year, and adding or subtracting from this value year by year an amount derived by dividing the sum of the moments by the sum of the squares of the intervals from the mid-point. There are several methods in common use to establish the secular trend, the one of moving averages being probably the most reliable for all purposes. Where the data exhibits straight-line tendency it is simpler to employ the straight-line "smooth." All the curves shown in Diagram 1 are of a decided straight-line trend, and it is therefore reasonable to smooth them by the straight-line method. The 1901-2 point of the secular trends was used as the base in converting the other points of the curves to a percentage or index-number basis. The scales, therefore, show percentage increase over the first year of the secular trends. The values for the actual points of these curves are given in Table 6. The similarity in the trend of the actual points of the first and second and the third and fourth curves is due to the data in the first and third curves being divided by total grassland figures, which are in straight-line trend. Had actual values been available for the latter throughout its entire range this could have been avoided. This point, however, does not detract from the value of the second and fourth curves. In Diagram 2 the secular trends of the six curves of Diagram 1 are given commencing from a common point, in order to show the relative increase of each on a percentage basis during the period under review. The secular trend is the most reliable base to employ in showing percentage variation during a period. Diagrams 3 and 4 show production of butterfat per cow and return per

TABLE 5.

Season.	Value or Standard Values of					Value of sheep-products per Sheep (as at 30th April).
	Dairy-products per Cow.	Total Products per Acre occupied.	"Smoothed" Total Products per Acre of Sown, Native, and Tussock Grasses.	Butterfat Production per Cow.	Percentage of Area occupied which is unproductive	
	(a)	(b)	(c)	(d)	(e)	(f)
	£	£	£	lb.	Per Cent.	£
1901-2 ..	7-942	0-512	0-640	127-20	19-08	0-604
1902-3 ..	7-720	0-564	0-667	123-48	20-46	0-732
1903-4 ..	8-139	0-542	0-695	130-34	21-38	0-725
1904-5 ..	7-988	0-517	0-723	127-83	21-09	0-647
1905-6 ..	7-803	0-534	0-750	124-74	22-12	0-643
1906-7 ..	7-795	0-608	0-778	124-79	22-27	0-704
1907-8 ..	7-980	0-600	0-806	127-66	22-23	0-649
1908-9 ..	8-609	0-651	0-833	139-25	23-19	0-678
1909-10 ..	9-277	0-686	0-861	148-45	24-84	0-679
1910-11 ..	8-710	0-690	0-888	139-46	26-41	0-724
1911-12 ..	8-757	0-672	0-916	140-10	26-49	0-692
1912-13 ..	9-424	0-694	0-944	150-78	26-58	0-695
1913-14 ..	9-782	0-766	0-971	156-52	26-67	0-759
1914-15 ..	9-636	0-793	0-999	154-07	26-75	0-769
1915-16 ..	10-036	0-773	1-027	160-52	26-84	0-752
1916-17 ..	10-252	0-717	1-054	163-96	28-85	0-695
1917-18 ..	9-518	0-690	1-082	152-23	29-31	0-832
1918-19 ..	9-417	0-766	1-110	150-64	29-22	0-742
1919-20 ..	9-502	0-796	1-137	152-04	29-12	0-822
1920-21 ..	9-645	0-795	1-165	154-25	28-93	0-808
1921-22 ..	10-932	0-899	1-192	174-97	28-60	0-943
1922-23 ..	11-292	0-864	1-220	180-62	28-50	0-767
1923-24 ..	10-879	0-899	1-248	174-10	28-06	0-767
1924-25 ..	11-380	0-934	1-275	182-09	27-85	0-748
1925-26 ..	11-213	0-936	1-303	179-40	27-50	0-760
1926-27 ..	12-408	0-996	1-331	198-50	27-16	0-781

TABLE 6.

Season.	Production of Lamb, Mutton, Wool, Butterfat, Beef, and Calf (based on Standard Values).			Sheep Units of Stock carried on all Grassland (each Cattle Beast equals Six Sheep).	
	Total Production (in £10,000).	Production per Acre of all Grassland (in £).	Production per Sheep Unit of Stock carried (in £).	Total Sheep Units of Stock carried (in 10,000).	Sheep Units of Stock per Acre of all Grassland.
1901-2	1571	0.553	0.551	2851	1.004
1902-3	1769	0.620	0.638	2772	0.971
1903-4	1760	0.614	0.632	2784	0.971
1904-5	1691	0.587	0.572	2955	1.026
1905-6	1756	0.607	0.567	3097	1.070
1906-7	1990	0.684	0.620	3209	1.104
1907-8	1991	0.682	0.597	3335	1.142
1908-9	2191	0.747	0.642	3412	1.163
1909-10	2340	0.794	0.657	3563	1.209
1910-11	2433	0.822	0.674	3612	1.220
1911-12	2338	0.786	0.644	3631	1.221
1912-13	2451	0.820	0.659	3722	1.246
1913-14	2719	0.906	0.710	3830	1.276
1914-15	2790	0.925	0.717	3889	1.290
1915-16	2804	0.926	0.714	3929	1.298
1916-17	2749	0.904	0.675	4072	1.339
1917-18	2604	0.852	0.595	4376	1.432
1918-19	2874	0.937	0.653	4404	1.436
1919-20	3027	0.982	0.712	4253	1.380
1920-21	3038	0.982	0.721	4212	1.361
1921-22	3475	1.118	0.824	4216	1.357
1922-23	3362	1.077	0.765	4397	1.409
1923-24	3467	1.106	0.768	4516	1.441
1924-25	3597	1.143	0.789	4557	1.448
1925-26	3594	1.137	0.788	4562	1.443
1926-27	3832	1.207	0.848	4520	1.424

sheep respectively, and are based on figures appearing in columns (d) and (f) of Table 5. Diagram 5 is based on the data shown in curves two, four, and five of Diagram 1, and gives the percentage variation of the actual points of these curves about the corresponding points on their secular trends. Imagine the inclined secular-trend lines of Diagram 1 brought to the horizontal and coincidence with one another, and this gives the significance of the zero line of Diagram 5. The actual points about the secular trends are plotted on a percentage basis in order to bring these to a common scale. Table 7 gives the readings of the plotted points. It is interesting to note that production per head of stock varies inversely with stock carried per acre of grassland between 1901-2 and 1905-6, and between 1915-16 and 1926-27. For the portion between 1905-6 and 1915-16 the correlation is direct, except for years 1907-8 and 1910-11. For later years we find that reduction in stock carried per acre has been coincident with increase in both production per head of stock and per acre of grassland.

SUMMARY

The total volume of production derived mainly from the grasslands of New Zealand has shown an appreciable increase over the period under review. It will be seen from Table 6 that, when measured in standard units, the rise has been steady (with minor fluctuations), rising from 1571 to 3832 units. The top line of Diagram 2 shows the trend of increase over the whole period, amounting to 136.7 per cent. The total increase has been contributed to by all branches of grassland products, but mainly by butterfat, lamb, wool, and beef.

The trend of increased production and efficiency is best studied from Diagram 2, where all features are shown starting from a common point.

It will be seen that—

- (1) The total grassland farmed has increased by 11.7 per cent.
- (2) When all cattle are reduced to sheep equivalents the total number of sheep units carried has increased by 69.7 per cent. Thus it is shown that the stock carried per grass acre has increased.
- (3) This increased carrying-capacity of stock units per acre of all grassland amounts to 51.8 per cent.
- (4) The total production of lamb, mutton, wool, butterfat, beef, and calf products has increased by 136.7 per cent., showing that—
- (5) The production per acre of grasslands has increased for these products by 109.9 per cent. As total production has increased more rapidly than have the units of stock carried or the area of grassland, we find that—
- (6) Production of lamb, mutton, wool, butterfat, beef, and calf products has increased by 37.2 per cent. per sheep unit of stock carried.

The increases given for (3), (5), and (6) when calculated directly from the base quantities—*i.e.*, (1), (2), and (4)—are respectively 51.9 per cent., 111.9 per cent., and 39.4 per cent, the variations being due to the operations of "smoothing."

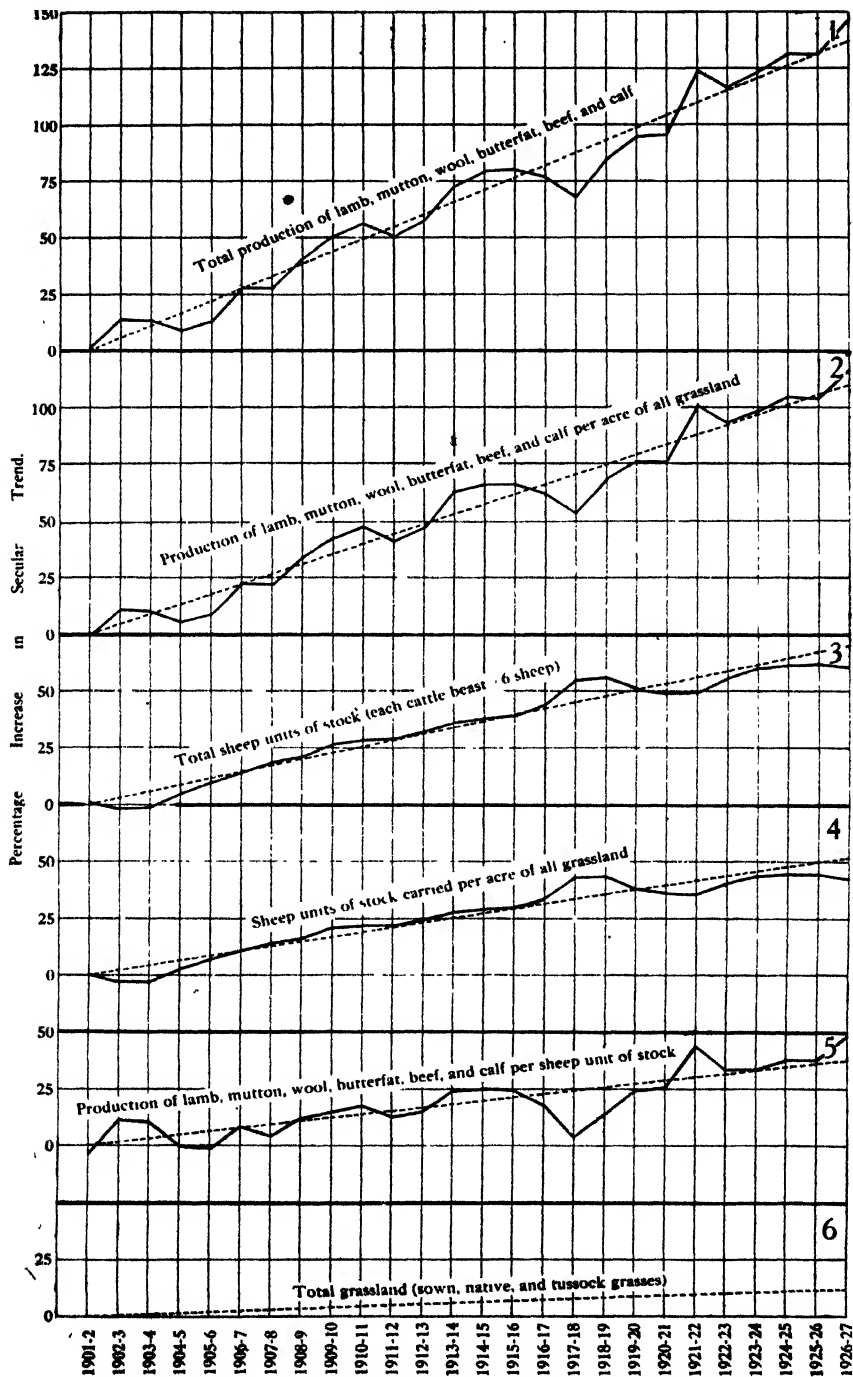
It must be appreciated that all animal products are not produced from grass alone, sown crops of the rape, turnip, and green-feed type being supplementary factors.

It should also be noted that capital represented by the increase in stock of all classes is considerable. This has not been included as an item of production, although it might justly be interpreted as such. Capital represented by increased area of improved land is in the same category. The data used represent the annual position from the farmers' viewpoint as nearly as it can be ascertained

TABLE 7.—PERCENTAGE VARIATION ABOUT SECULAR TREND.

Season.	Production of Lamb, Mutton, Wool, Butterfat, Beef, and Calf per Acre of all Grassland.		Sheep Units of Stock carried per Acre of all Grassland.		Production of Lamb, Mutton, Wool, Butter- fat, Beef, and Calf per Sheep Unit of Stock carried.	
	Per Cent.		Per Cent.		Per Cent.	
1901-2	-0.896	+0.299	-3.839	
1902-3	+6.346	-4.990	+9.621	
1903-4	+1.153	-6.903	+7.118	
1904-5	-7.120	-3.480	-6.507	
1905-6	-7.469	-1.291	-6.589	
1906-7	+0.440	-0.090	+0.649	
1907-8	-3.262	+1.420	-4.326	
1908-9	+2.328	+1.483	+1.421	
1909-10	+5.305	+3.598	+2.496	
1910-11	+5.519	+2.693	+3.692	
1911-12	-2.117	+0.992	-2.127	
1912-13	-0.966	+1.300	-1.199	
1913-14	+6.338	+2.080	+5.185	
1914-15	+5.473	+1.494	+4.824	
1915-16	+2.774	+0.464	+3.179	
1916-17	-2.375	+1.980	-3.708	
1917-18	-10.410	+7.426	-16.078	
1918-19	-3.897	+6.056	-9.052	
1919-20	-1.800	+0.363	-1.928	
1920-21	-4.101	-2.507	-1.904	
1921-22	+6.577	-4.166	+10.901	
1922-23	+0.372	-1.948	+1.728	
1923-24	+0.728	-1.165	+1.052	
1924-25	+1.871	-2.096	+2.600	
1925-26	-0.871	-3.735	+1.415	
1926-27	+3.074	-6.315	+7.888	

DIAGRAM 1.



DIAGRAMS 2, 3, AND 4.

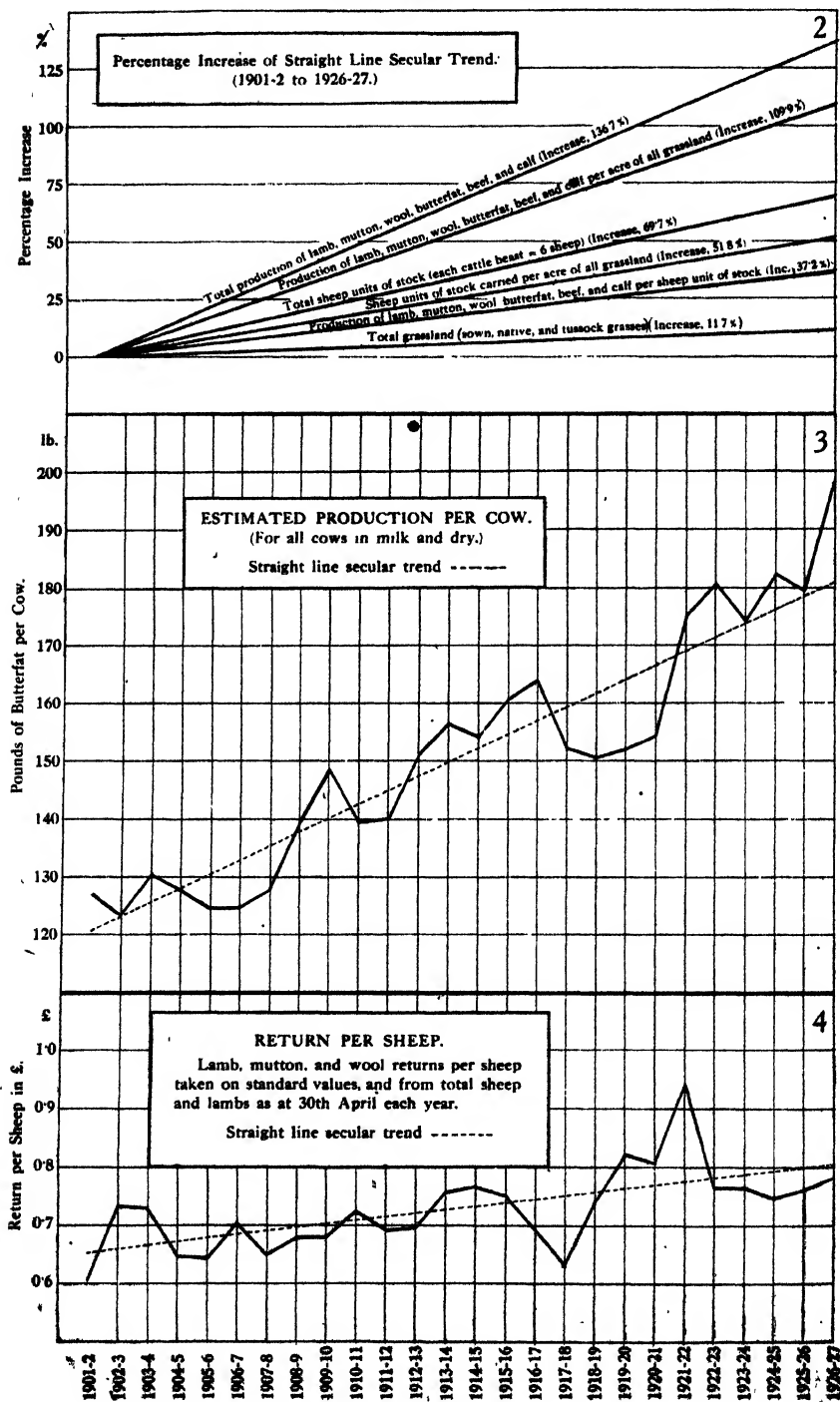
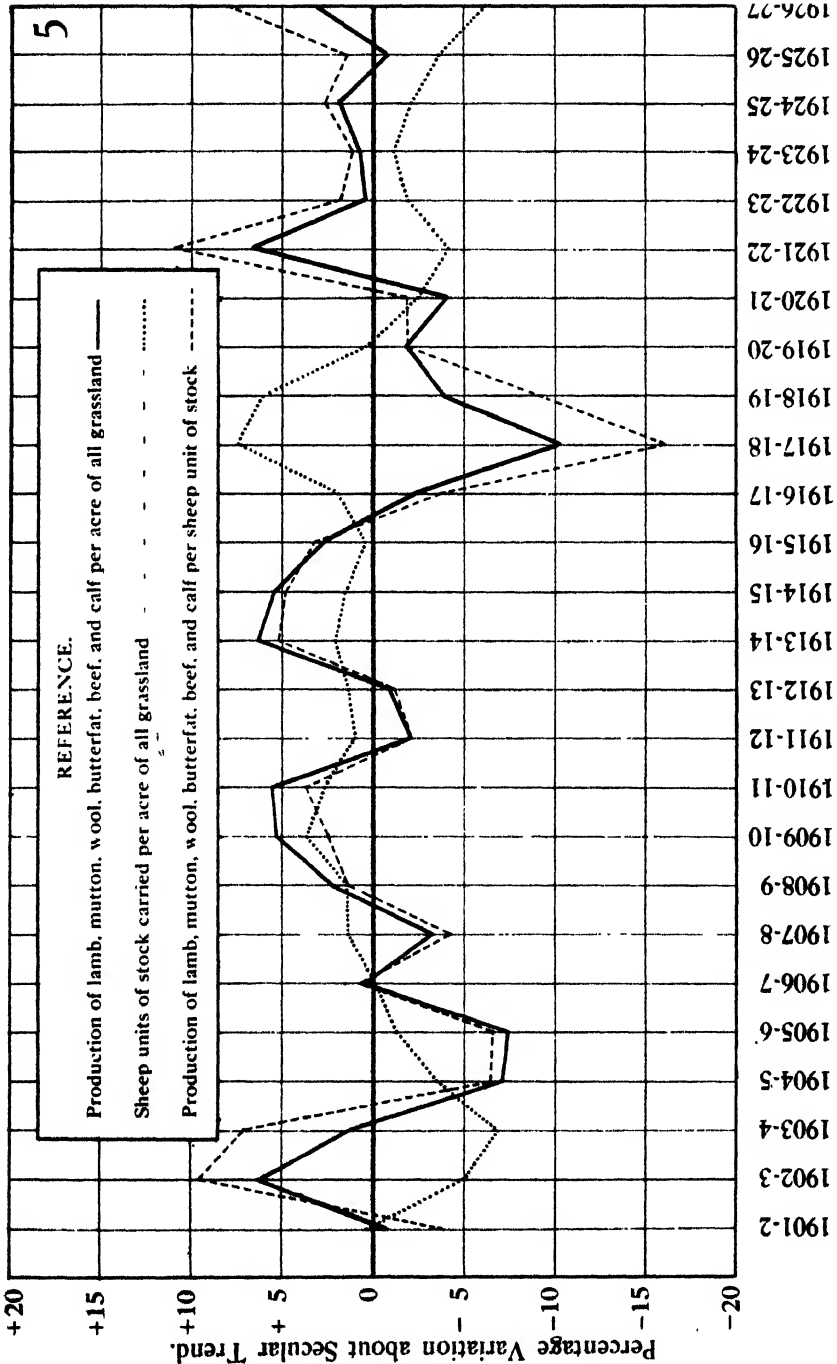


Diagram 5.



WEATHER RECORDS : MAY, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

MAY was a very dry month over the whole of the South Island and the greater portion of the North Island. The only areas where the total rainfall exceeded the average were the Auckland Peninsula and most of the Gisborne and Hawke's Bay districts. Many places in the South Island experienced the lowest May rainfall since records have been kept.

Although temperatures, on the whole, were lower than usual, there was an absence of strong wind, except for short periods, and thus, combined with the frequency of sunny days, was conducive to an excellent growth of pasture for this time of the year.

The main meteorological feature of the month has again been a relative absence of westerly winds, owing to pressure systems of the cyclonic type having been most prominent. The only depression of the westerly type of any importance experienced was one which prevailed between the 8th and 10th, and the greater part of the rainfall registered in Westland was associated with this disturbance.

There were a number of small cyclones, which in most cases passed across northern New Zealand, and brought rain mainly to the northern and east coast provinces of the North Island.

The most notable storm was a cyclone which appeared first on the 11th as a small centre to the north-west of Cape Maria van Diemen. Gradually increasing in extent and intensity as it moved southwards, it affected all parts of the Dominion, rain being general between the 14th and 16th. From Marlborough northwards stormy conditions prevailed with strong south-east to south winds, which in some places reached gale force. Very heavy rains fell in the east coast districts of the North Island. Rivers overflowed, and much of the lowlying country in the Wairarapa, Hawke's Bay, and Gisborne districts became flooded. Many bridges were carried away and roads were damaged, serious interference with traffic resulting. Although there was some loss of stock, the ample warning of floods enabled farmers to take all possible precautions. The loss, therefore, was far less than it might otherwise have been. On the 15th this cyclone was centred north of the Bay of Plenty, and by the 16th it was moving off East Cape. By that time its worst effects were over.

Anticyclonic conditions and fine weather were general from the 17th to the 19th, but thereafter until the 29th the weather was somewhat unsettled and changeable with scattered rain, chiefly in eastern districts. During this last period several cyclones moved over the northern Tasman Sea and across northern New Zealand, but their effects were not widespread. On the 28th some severe hailstorms were experienced at places in the far North in association with a cyclone the centre of which passed north of Cape Maria van Diemen during the night of the 27th. Fine weather set in on the 29th and continued until the close of the month, an extensive anticyclone gradually intensifying over the Dominion.

Frosts were frequent during the month, and on the 31st a severe one occurred in many parts.

—Edward Kidson, Director of Meteorological Services.

RAINFALL FOR MAY, 1929, AT REPRESENTATIVE STATIONS

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitaia	6.57	15	1.30	5.06
2	Russell	11.64	20	1.24	5.92
3	Whangarei	13.68	24	2.94	7.84
4	Auckland	4.10	21	0.87	4.50
5	Hamilton	2.42	11	0.70	4.54
6	Kawhia	3.22	11	0.73	5.57

RAINFALL FOR MAY—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
<i>North Island—continued.</i>					
		Inches.		Inches.	Inches.
7	New Plymouth ..	4.35	11	1.18	6.23
8	Riversdale, Inglewood ..	4.29	11	1.30	9.82
9	Whangamomona ..	6.49	9	1.20	7.05
10	Eltham ..	3.30	13	0.93	5.27
11	Tairua ..	6.91	14	1.41	7.04
12	Tauranga ..	2.84	11	0.98	5.16
13	Maraekaho Station, Opotiki	5.46	10	1.86	5.70
14	Gisborne ..	8.33	19	3.05	5.07
15	Taupo ..	2.93	10	0.67	4.00
16	Napier ..	5.57	14	2.57	3.74
17	Maraekaho Station, Hastings	7.01	15	4.04	3.52
18	Taihape ..	1.95	11	0.43	3.84
19	Masterton ..	3.33	14	1.01	1.03
20	Patea ..	2.80	11	0.68	4.34
21	Wanganui ..	3.03	9	0.93	3.42
22	Poxtton ..	3.02	6	1.04	2.78
23	Wellington (Karori Reservoir)	4.29	11	1.34	4.40
<i>South Island.</i>					
24	Westport ..	2.75	9	1.05	6.58
25	Greymouth ..	3.98	8	1.12	8.01
26	Hokitika ..	3.98	9	1.56	9.71
27	Ross ..	4.45	8	1.26	9.73
28	Arthur's Pass ..	5.37	6	2.50	11.02
29	Okuru, Westland ..	4.06	6	1.95	11.60
30	Collingwood ..	2.82	10	0.71	10.18
31	Nelson ..	0.54	7	0.20	3.08
32	Spring Creek, Blenheim ..	0.49	5	0.12	3.19
33	Tophouse ..	2.17	7	0.73	5.94
34	Hannier Springs ..	2.17	6	1.26	4.51
35	Highfield, Waiau ..	1.88	5	0.86	3.41
36	Gore Bay ..	1.03	5	0.70	3.83
37	Christchurch ..	0.51	5	0.27	2.05
38	Timaru ..	0.46	4	0.28	1.41
39	Lambrook Station, Fairlie ..	0.87	2	0.44	1.53
40	Benmore Station, Clearburn	0.46	5	0.28	1.97
41	Oamaru ..	..	..	..	1.61
42	Queenstown ..	0.64	3	0.36	2.63
43	Clyde ..	0.26	2	0.24	0.97
44	Dunedin ..	0.50	6	0.37	3.23
45	Wendon ..	1.08	7	0.37	2.23
46	Gore ..	1.48	11	0.58	2.71
47	Invercargill ..	2.46	12	0.85	4.46
48	Puysegur Point ..	5.93	17	1.30	6.81
49	Half-moon Bay ..	2.81	11	0.53	4.50

FOOT-AND-MOUTH DISEASE IN BRITAIN.

THE High Commissioner reported by cable from London on 4th June that there had been no outbreak of foot-and-mouth disease in Great Britain since 24th March last. Although it must not be inferred from this that the disease has been entirely eliminated, the information discloses a much more satisfactory position in Britain than has obtained for a considerable time past.

REVIEW.

The New Flora and Silva: A quarterly horticultural journal, edited by E. H. M. Cox, F.L.S. Dulau and Co., Ltd., London. Annual subscription, £1.

THE flora of the earth—that collection of species forming a living mosaic covering much of its surface, and known as the vegetation—though changing with unthinkable slowness, yet has remained unchanged since the beginning of historical time. On the contrary, the flora of our gardens has never remained stationary, but, even during the last quarter of a century, has altered greatly, partly through the dictates of fashion, partly through the self-sacrificing exertions of botanical explorers, and partly through the skill of the plant-breeders. Thus the title of the journal under review—*The New Flora and Silva*—though to some it may seem rather odd, is an excellent statement of facts. Those of us no longer young have witnessed change after change in the horticultural flora, so that at the present time it resembles but little that of the mid-Victorian period. It is true that the word “Silva” is really included in the term “flora,” but the use of the two emphasizes the fact that the journal deals not only with the herbaceous plants and shrubs of gardens but with the trees of parks, plantations, and woodlands.

Considering that Great Britain leads the world as a land of flower-gardens, it seems rather strange that, up to the advent of the new journal, there were only the two weekly horticultural papers—both playing an important and worthy part—and the *Journal of the Royal Horticultural Society*. But in these a considerable portion of the contents consists of general news, whereas such finds no place in *The New Flora and Silva*, its pages being devoted entirely to articles treating of the subjects its title indicates, but omitting matter connected with bedding-out and the like. “There is no intention”—quoting from the editorial in the first number—“of casting aspersions at tried favourites or of belittling the ordinary gardener who likes to see his soil produce excellent crops and his beds blaze with colours, but his tastes are well covered by other horticultural journals. What has been lacking is a journal which caters solely for the keen gardener who is ambitious, for the gardener who is interested in particular groups of plants, for the gardener who wishes to enlarge his collections, and, above all, for the gardener who desires to learn about the best plants and the best methods of cultivation.”

Judging from the first two numbers—all published so far—the foregoing objects stand out clearly in their twenty-five articles, all contributed by horticulturists of note—e.g. (to name a few), W. J. Bean (Kew), E. A. Bunyard, Gertrude Jekyll, R. L. Harrow (Edinburgh), Lady Moore, Camillo Schneider, and E. H. Wilson (Arnold Arboretum). To give some idea of the value of the contents (taken almost haphazard) for New Zealand gardens, there is an account of those primulas sufficiently easy of cultivation as to permit their use in the “wild garden”; new sweet-peas are critically dealt with; very timely is the article on “garden favourites of seventy years ago” (what a long list could be drawn up for this country of the banished plants, whose return to our gardens would be indeed welcome); varieties of *Delphinium* specially worthy of cultivation; much-wanted notes on the species of *Berberis*; and a delightful article (one of a series) on cherries, under the title “The Anatomy of Dessert.”

That the journal will be ably conducted is evidenced by the fact that it is under the expert editorship of E. H. M. Cox—gardener, botanical explorer, and admirable horticultural writer. Its format leaves little to be desired, with the good paper, clear print, and excellent illustrations. In short, the reviewer can confidently recommend the new magazine to those New Zealand amateur gardeners who wish their gardens to be full of beauty and of interest throughout the year, and are not content to slavishly follow any prevailing fashion, but who may not know what is best to grow, be such novelties or old favourites—indeed, both to skilled and unskilled it pages should appeal.

L. C.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BLINDNESS IN SHEEP.

P.T.B., Ongarue :—

Fifteen to twenty of my ewes are troubled [month of May] with complete blindness. A cataract has come over both eyes, being abnormal on the pupil. The worst affected sheep are unable to be driven, and wander into obstructions, thus injuring themselves. Would you advise me what means to adopt to allay the complaint.

The Live-stock Division :—

When sheep are on the flush autumn feed, or even later when they are on turnips, it is not rare for them to become affected with blindness. The affection appears to be caused by some disturbance of the digestive system due to an unbalanced diet. The complaint is usually of a temporary nature, and will generally disappear from a flock if the sheep are changed on to a short, sweet pasture. We would suggest that you give your sheep as much exercise and as much change as possible by moving them at least every third day. The affected ewes should be dosed with Epsom salts, 4 oz. dissolved in a large cupful of hot water being the dose required. A few drops of an eye-lotion, made by dissolving $\frac{1}{2}$ dram of sulphate of zinc in a pint of boiled water, should be poured on to the affected eyes daily. Another eye-lotion is made by dissolving 1 oz. of boracic acid in a pint of water.

CONTROL OF TUTU.

"TUTU," Balclutha :—

Could you give me any information on destroying tutu? It is of the small variety, grows annually from below ground, and is situated on fairly steep faces.

The Fields Division :—

From the description of the tutu in question we presume that it is either *Coriaria thymifolia* or *Coriaria angustissima*. The latter variety is recognized by its rather large blackish fruit. The eradication of this plant has been a bane to many farmers, and numerous methods have been adopted, but results have not been very satisfactory. Where and when practicable the most efficient method is to grub it out. A method which has been tried with some success is that of herding goats on the patches of tutu, penning them for some time on the infected areas, when they have been known to eat quite a large proportion of the plant.

LONG KEEPING OF ONIONS.

J.D., Okeia :—

I should be obliged if you would let me know the best way to grow onions which will keep late in the season. I had an excellent crop the last two years. They were well ripened when harvested, and hung in a cool airy shed, but from now on they get soft. I have been in the habit of sowing Giant Rocca and Ailsa Craig in the autumn and Brown Spanish in the spring.

The Horticulture Division :—

To keep onions in good condition until late in the season is not an easy matter even under the best circumstances, and some growers even go to the expense of placing them in cold storage. The climate of your locality is not such as one would expect to grow a type of onion with first-rate keeping-qualities. Of the varieties you mention the Brown Spanish only should be retained for late use, and of these only the medium-sized bulbs. With small quantities these may be

strung, and kept in a place that is not only cool and airy but also dry. A dressing of 1 oz. sulphate of potash per square yard before sowing would very possibly improve the condition of the onions for storage purposes, but if the crop has to be harvested in moist weather it is best to make no attempt to keep it for a long period.

WINTER GRAZING OF YOUNG PASTURE.

D. M. BLACK, Riverton :—

What number of lambs will 20 acres of oats and grass sown on 12th March winter, hay being fed as well? Would feeding off during July and August affect the growth of cocksfoot? There is a fine strike; 2 bushels of Algerians were sown with the usual permanent pasture mixture.

The Fields Division :—

As a permanent grass mixture has been sown with the oats, and as the establishment of grass is the ultimate aim, every care in grazing should be taken through the first year. For this reason it is not advisable to put out a mob of lambs or other stock and pasture them solely on this crop. The result of such a course is usually a field grazed in a patchy manner, with the young sweet herbage getting too drastic a grazing, and some being left to run rank. Rank growth in a young pasture during the winter soon makes the "bottom" colourless and fuzzy. Also, the closely grazed herbage would receive too much attention, and the slower establishing and hence more permanent elements like cocksfoot would receive a set-back. Your best plan would be to graze the pasture when about 5 in. to 6 in. high with a mob of, say, seven hundred to eight hundred lambs. It would be even better to divide the field in half with a temporary netting fence and graze off with two separate mobs of lambs, or graze alternately, never letting the growth get above 6 in. and never grazing it below 5 in. high. Whereas it is correct practice to graze at a short stage of 3 in. to 4 in. during the summer months, it is not advisable to graze so close during winter. Use a light harrow after the lambs to sweeten the pasture. Close the field again until another 5 in. to 6 in. growth is forward, then graze off again. The grazing-off should be done fairly quickly in, say, seven to ten days at the most, and if the number of lambs cannot cope with the growth in this time more sheep should be placed on the area. This system of grazing would allow you to get the full utilization of your oats without impairing the young grass unduly. Certainly continuous grazing throughout July and August would seriously affect the grass-growth. It might pay you well to top-dress this block with about $\frac{1}{2}$ cwt. to 1 cwt. of sulphate of ammonia per acre after the first grazing. This would force the growth of both oats and grass, and give you extra grazing during the early spring before pasture growth is well forward.

STOCK SLAUGHTERED, 1928-29.

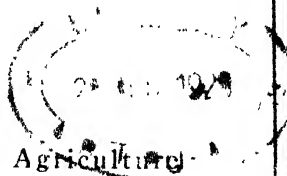
FOLLOWING are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1929 :—

Stock.	Abattoirs.	Meat-export Slaughter- houses.	Bacon- factories.	Ordinary Slaughter- houses.	Totals 1928-29.	Totals 1927-28.
Cattle ..	155,302	165,643	..	82,385	403,330	462,639
Calves ..	50,457	342,582	..	1,948	394,987	163,380
Sheep ..	584,856	2,156,034	..	239,176	2,980,066	3,180,274
Lambs ..	95,982	6,031,011	..	22,489	6,149,482	5,932,420
Swine ..	129,641	270,084	45,084	25,684	470,493	455,397

—Live-stock Division.

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No. 1

STRAIN INVESTIGATION RELATIVE TO GRASSES AND CLOVERS.

E. B. LEVY, Agrostologist, and W. DAVIES, Plant Geneticist, Plant Research Station, Palmerston North

Introduction.

GRASSLAND research in New Zealand is directed towards a threefold goal: (1) Knowledge of just what species of grasses and clovers fit the growth conditions* as these exist on the farm at the present time; (2) knowledge of how best we can modify or change existing growth conditions on the farm; (3) knowledge of what part strain or type selection within the species plays in the making or marring of a pasture.

Each grass and clover has what we term a habitat range, and each demands a special set of conditions in order that it may thrive. In other words, each grass and clover is an indicator of its own environmental conditions. That great mosaic grassland complex is but the grouping of ecologically alike species into large or small association types as an outcome of variation in the conditions of the habitat. The more variable the conditions throughout any one given area the more complex the mosaic; the more uniform the conditions of the habitat the less real does this mosaic become.

As regards the hill country, the writers freely admit little likelihood of rapidly changing this mosaic grassland complex, but on good arable country that can be drained, ploughed, seeded down, manured, harrowed, grazed, and managed aright there should not exist that mosaic of associations. There should not be seen rye-grass by the gateways; rough cocksfoot further afield; patchy rank growth about droppings; hollows of creeping-bent and Yorkshire fog; clumps of tall fescue, worthless brown tussocks of rushes; patches of catsear, hawkweed, field-daisy, buttercup, or pennyroyal. This mosaic of association types tells of disparity within the conditions of the habitat,

* Growth conditions may be defined as (a) edaphic—those appertaining to the soil, its chemical, biological, and mechanical nature, its moisture or water-laden state; (b) climatic—temperature, sunlight, precipitation, wind; (c) growth reactions and competition, and herbage utilization by grazing, ensiling, haying, burning.

and the problem is a reconditioning of those soil-types, a levelling-up of the habitat conditions, and the improving of these up to the point where perennial rye-grass and white clover automatically take up the running as the dominant species in the pasture.

While one is apt, then, to visualize the species as stable or fixed, and to assert replacement and displacement, rise and fall of association types in response to the environment, yet there is unquestionably a variation within the species—a product of the environment. Danish cocksfoot differs in colour, in form, and in persistency from Akaroa cocksfoot; Kentish wild white clover differs from both Lodino and commercial Dutch white clover; Hawke's Bay rye-grass differs in growth-form, palatability, shade of colour, and persistency from Southland rye-grass; broad red clover differs markedly in form, persistency, and time of flowering from Cornish Marl or Montgomery red clover. The question arises as to whether these variants are exploitable. Can we by strain-selection widen, as it were, the habitat range of a species?

Strain-selection has unconsciously, but none the less surely, gone on in all arable-land-farming communities in New Zealand for the last forty to fifty years. Quick-maturing and free-seeding types of rye-grass, for example, have been sown and harvested—sown and harvested, over and over again. The slower-maturing, tardy seed-producing, leafy strains have figured in lesser and lesser degree, until to-day a free-seeding, rapidly maturing, more or less annually inclined rye-grass type has been developed—the outcome of unconscious, unguided strain-selection. On the other hand, areas have remained in permanent grass here for decades, and in England for centuries. These have been subjected to an entirely different set of environmental conditions, and survival of the sward components has been determined largely by two things: (1) The ability to reseed, and (2) the ability to persist by vegetative spread, as by tillering. In the latter case, where re-establishment through reseeding is not possible, only those strains that possess the character to tiller well will survive, and thus in all probability arise long-persistent, dense-crowned, multi-tillered, leafy types—the ideal types for true permanent pasture.

Accepting variation within the species as inevitable, the question set before us is to solve for just what niche in the economy of grassland farming the species and its variants are best fitted. The question we have to solve as consumers or users of the existing commercial strains or variants is whether they are suited for the purpose on which we are bent.

The strictly arable type of farming calls largely for the annual, the quick-establishing, rapid-growing, quick-maturing short-lived types of plant. The short-rotation grassland farmer requires temporary and short-lived high-production pastures to fit this crop-rotation system, and for such pastures, again, the quick establisher, quick-growing, free-seeding, non-persistent types of grasses are in demand. For the truly permanent pasture the demand is entirely different from either of the foregoing. The one sowing is spread over a long period of production, hence cheapness of sowing is not so essential. Long-lived, leafy, multi-tillered, vegetatively reproducing species are essentially in demand. It is a question of sowing species or strains for specific conditions;

and just as it is fatal to sow true perennial rye-grass where the conditions are suitable only for, say, *Danthonia pilosa*, so it is equally fatal to sow a rye-grass developed for arable, temporary, or short lea conditions on country where the demand is for perennially grazed pastures of long duration. Again, the cocksfoot for rank growth conditions must be essentially a different cocksfoot from that of perennially well-grazed pastures. The stemmy, free-seed-production types which it is possible to secure under cultivation and non-stocking conditions differ in utility from those of the grazed pasture, and it is obviously wrong to use such types where perennially grazed pastures are demanded.

The same principle applies to the clovers. South European conditions of small holdings and arable farming call for the free-seeding, quick-growing, early maturing white clover and red clover. Their type of farming has evolved such strains, and for their purpose such strains may be excellent, but when we actually examine the types of white clover existing in the old pastures of Kent or of Hawke's Bay, or the types of red clover in Montgomeryshire and Cornwall, these are not the annual, free-seeding, quick-maturing, short-lived strains, but are long-lived, leafy, and multi-tillered strains evolved to withstand the punishment of perennial stocking. They are attuned to the grazed sward environment; they rely on persistence by vegetative spread, as by tillering and by free root-development at node and crown. The crowns are protected by denseness of growth and by close proximity to the surface of the soil, and thus gives shade to the base of the crown, and conserves moisture there, so that free root-formation may continue over as long a period of the year as possible. Compare such with the few-tillered, open-crowned, non-vegetatively-reproducing types of short-lived pasture plants carrying their crown well above the soil.

1. PERENNIAL RYE-GRASS.

SOURCE OF PRESENT-DAY SUPPLIES.

From the foregoing remarks it will be fairly obvious that source of origin and a knowledge of the conditions under which the crop has been grown must be our main guide in the buying of grass and clover seed for pasture work—be those pastures temporary, short-rotation, or truly permanent pastures. What concerns New Zealand most at the moment are grass and clover types suitable for true permanent pasture, and the point the writers wish specially to stress here is that those grasses and clovers must conform to types that are bred for permanent-pasture work.

Table 1 (next page) sets out very clearly the position in regard to commercial perennial rye-grass as sold in the New Zealand markets at the present time, with reference to perennial and annual types. These data show conclusively that the Italian or annual type of rye-grass is markedly in evidence in commercial lines of perennial rye-grass at present being harvested in New Zealand, and offered for sale under the name "perennial rye-grass" or simply "rye-grass." When it comes to defining the position in relation to short-lived types other than the strictly annual type

Table 1.—Strain Analyses of 827 Lines of Commercial "Perennial" Rye-grass.

Type.	Hawke's Bay (including Poverty Bay)	Sandon	Wairarapa.	Marlborough.	Mid- Canterbury.	South Canterbury.	Southland.	Central Otago.	Imported.
Pure perennial lines ..	118	55	..	4	17	3	71	1	5
Dominant perennial lines with trace of Italian	27	17	3	5	8	..	40	3	9
Dominant perennial lines with some or much Italian	24	35	4	2	27	15	133	5	4
Mixed perennial and Italian lines—approximately half of each	2	10	3	..	28	22	49	1	1
Dominant Italian lines ..	2	2	1	1	11	43	10	..	..
Totals	173	125	11	12	91	83	303	10	19

the problem becomes a little more difficult, and some time will be necessary before definite results can be tabulated.

From evidence secured to date there is no doubt there are marked differences in growth-form, colour, and persistency between the perennial rye-grasses of varying origin, apart altogether from the Italian or annual types present. There are true perennial types and pseudo or false perennial types. The true perennial types are dark-green in colour; the pseudo-perennials are lighter in colour. The true perennial types are all flat-stemmed, with leaves in bud definitely folded and narrowly V-shaped; the pseudo-perennials are rounded in stem section, and tend to be more fleshy in the bud shoot, which is U-shaped rather than V-shaped. The tiller shoots of the true perennial become more densely packed and tend to be erect rather than prostrate; the pseudo-perennials are more sparsely tillered, laxer in the crown, and the shoots widely divergent and spread out rather than erect. These are morphological characters difficult to define, however, and the real test of the true as against the pseudo or false is that of longevity or persistency.

The origin, production, and perpetuation of these pseudo-perennial forms can be set down largely as a result of the type of farming practised and the influence of ruling climate. There seems little doubt that the Southland perennial rye-grass has a more definite winter form than the North Island perennial. This winter form may be the outcome of adaptation to the severer climate of the South, and whether the true perennials of the North are superior in the South to those of the South still remains to be definitely proved.* Certainly the true perennial rye-grasses of the North are markedly superior in the North to those equal winter

* Evidence on English rye-grass obtained at Aberystwyth (Wales) would lead the writers to suggest that this winter form bears no relation whatever to climate, but is the normal growth-form of the non-persistent, short-lived rye-grass.

forms of the South. Virtually the whole of the rye-grass of the South at present on the market is of the pseudo-perennial type; and whatever the origin of these pseudo-perennial types, whether it is due to climate, to the type of farming practised, or whether it is due to hybridization, or crossing annual and perennial types, the fact remains that these pseudo-perennial types are not suited for truly permanent pasture work.

Table 2 sets out the results of field tests under grazing on four different soil-types in the North Island. The Hawke's Bay old pasture, the Hawke's Bay maiden, and the Sandon rye-grass lots were true perennial type. The Southland is a typical blended line from that district, and the Canterbury is a typical blended perennial type from mid-Canterbury.

Table 2.—Point-quadrat Analyses on Four Different Areas sown to Rye-grass of Different Origin in Autumn of 1928.

The figures represent the percentage of ground covered by rye-grass in each mixture.

Area.	Hawke's Bay Old Pasture	Hawke's Bay Maiden	Southland	Sandon	Canterbury.
<i>1. Analyses made two months after sowing</i>					
Central Development Farm, Wairaroa	53	58	55	55	53
Marton	43	42	41	40	35
Katere, North Taranaki	37	45	43	35	37
Manaua (not analysed)					
Average ..	44	48	45	43	42
<i>B Twelve months after sowing.</i>					
Central Development Farm, Wairaroa	70	77	26	72	9
Marton	39	46	28	45	17
Katere	52	59	12	41	1
Manaua	44	55	20	58	15
Average	54	59	22	54	11

These figures are extremely significant. The true perennial has made good headway and has increased markedly at the end of twelve months, whereas the pseudo-perennial (the Southland type) has decreased by more than half, and the annual and pseudo-perennial Canterbury type has virtually disappeared from the pasture. Each of these areas was laid down with 4 cwt. carbonate of lime and 3 cwt. superphosphate at time of sowing, and during the following winter were top-dressed with 3 cwt. super or slag, plus (on portions of each plot) $\frac{1}{2}$ cwt. sulphate of ammonia and sulphate of potash, per acre. Even under these liberal dressings the pseudo-perennial and the annual types failed to survive in sufficient quantity to make a pasture.

It is difficult to estimate the harmful effect these pseudo-perennial and annual rye-grass types have had on the grasslands of New Zealand as a whole. So persistently have these types failed after the first year that there has arisen a large school that claims this thinning-out of rye-grass as inevitable, and maintains it were better to bring a

pasture back by manuring rather than by ploughing up and resowing. The writers maintain that much of this failure (apart from heavy smother such as is produced by red clover or too much Italian rye-grass, rape, &c.) of the pasture in the second year onwards is due largely to the use of the wrong type or strain of rye-grass. The true perennial is a "sticker"; it can withstand hard punishment and starvation conditions of a temporary nature.

The knowledge that this failure can be to a large extent avoided, and that if a genuine perennial be sown there will persist a rye-grass that will respond to manuring and pay handsomely from the time of renewal, will be far-reaching. The writers venture to suggest that just so soon as we can get back on to the market genuine perennial rye-grass at a reasonable price there will be a revival of the plough, and subsequent manuring of a turf that is worth while.

New Zealand is extremely fortunate that she has at hand a good perennial rye-grass type probably equal to any commercial strain throughout the world—the Hawke's Bay type. Not that all seed from this source is genuine perennial; but at comparatively small expense the genuine crops may be identified, and, with these as a nucleus, mother seed can be produced; and this once grown will soon furnish a sufficiency of the genuine article for all New Zealand's requirements at least. This is the urgent problem, but it must be followed up by detailed work to isolate the "super" strains, as it were, from the general mass of Hawke's Bay and other true perennial rye-grass types.

SEED-PRODUCING DISTRICTS OTHER THAN HAWKE'S BAY AND POVERTY BAY.

It must not be presumed that Hawke's Bay and Poverty Bay are the only districts in New Zealand that can produce the true perennial rye-grass seed. The Sandon district (Wellington province) contains much good perennial rye-grass practically identical with the Hawke's Bay strains, and with a small amount of work and care in the elimination of the mixed and dominant Italian and pseudo-perennial types that have crept in, this district would rapidly come back to its own as a recognized true perennial-seed producer.

There must exist also in Canterbury and Southland quite a large number of areas where truly persistent perennial rye-grass is growing, and there is always the possibility that such areas may carry strains superior even for the purposes of permanent pastures in those districts than any strain that could be introduced there. The determination of just where these true perennial strains are growing, and the harvesting of these as mother seed, is a job that must impress itself seriously upon farmers in Canterbury and Southland. At the present time seed is not produced from these old-standing perennial rye-grass pastures. They do not affect the present position, and as far as the seed on the market at the present moment is concerned they might as well not exist.

MAIDEN-SEED PRODUCTION FROM APPROVED MOTHER STRAINS.

The course it would seem desirable to take in order to put true perennial rye-grass back on to the market at a reasonable price is, firstly, to earmark areas of the correct strain, and to take seed crops from these areas, such seed to be regarded as mother seed which is set aside

for maiden-seed production. The production of this maiden seed may take place in any district that is eminently suited for seed-production, such as Hawke's Bay, Poverty Bay, Sandon, Wairarapa, Marlborough, Canterbury, Otago, and Southland. A certain amount of precaution would be necessary to preclude the possibility of volunteer rye-grass contaminating the crop, but just so long as this maiden seed is used only for pasture establishment, and not for other seed crops, a small amount of contamination with other strains is not serious if the crop is dominantly of the true perennial type. The feeling that exists against maiden seed as compared with old-pasture seed has to a large extent arisen from the fact that maiden seed is possible from any strain—annual, short-rotational, or permanent—whereas the old pasture, it is claimed, *must* represent the right long-lived type. As a matter of fact, this latter claim is true only to a certain point. As already mentioned, old pastures may persist either by reseeding and re-establishment or by vegetative tillering. It is very certain that rye-grass crops from very fertile soils which freely admit of re-establishment of seed shed do contain a high percentage of Italian rye-grass, and in some few instances dominant Italian rye-grass crops have been produced from areas that have not been broken up for the last twenty to thirty years.

This only emphasizes the importance of strain and the necessity of some guarantee as to trueness to type. To the writers it would appear that trueness to type is more important than old pasture, but certainly it is to the old pastures that we shall look, for the start at least, for the production of mother seed. Old-pasture mother seed of the correct type should give a progeny—*i.e.*, maiden seed—that is in every respect equal to itself. In other words, just so long as the parent is pure and of good type the maiden offspring will also be of the correct type. It is only when the maiden seed is itself harvested for seed, that crop sown and again harvested for seed, which in its turn is again sown and harvested for seed *ad infinitum*, that the tendency is towards perpetuation and increase of the freer-seeding, quick-maturing annual or short-lived types, which exist in small proportion even in the best old-pasture lines, to the suppression of the slower-establishing, leafy, longer-maturing, true perennial types.

It would seem highly advisable that mother-seed areas should be proclaimed in whatever district the true type of perennial rye-grass is shown to exist, and that the grower of maiden seed for pasture purposes should come back to these mother-seed areas for regular supplies of seed from which to produce the maiden seed.

It is very gratifying to the writers to know that certain seed firms have already taken up the production of maiden seed from this genuine type Hawke's Bay mother seed. Concerted action between the Department of Agriculture, the seed-grower, and the seed trade will soon right a position that was fast becoming untenable.

THE PERENNIAL RYE-GRASS POSITION IN BRITAIN.

The strain position among pasture plants in Britain as it relates to ordinary commercial grasses and clovers is not good. Knowledge in regard to strain there, however, has made considerable advance during the past decade, and there are indications that this knowledge is being actively applied by seed-merchants at Home.

The great bulk of commercial grass and clover seed used in England is still, however, of the annually inclined type, and as such is totally unsuitable for the laying-down of high-grade permanent pasture. It has been a common occurrence to find sown pastures run out badly after the second year, and attempts to retain their floristic composition at the rye-grass and white clover standard have failed even with liberal manuring. On many classes of land it is many years before a sown-down pasture will make a productive grass sward, and even so the resultant pasture carries a high proportion of flat-weeds.

In England there have long arisen two opposing schools of thought; the one strongly recommends the manure-bag as the means of pasture improvement and development; the other holds that it is better to rely on temporary grass, and to plough and resow every few years—to treat grass as an arable crop, as it were, and to replough at the point when the sown species die out completely.

In the field of seed-production a certain small quantity of perennial rye-grass is saved annually from old English pastures, but this constitutes only a minor proportion of the total rye-grass seed used each year. By far the greater proportion of rye-grass seed consumed in Britain is of the annually inclined type, similar in character to the Southland rye-grass of New Zealand. English old-pasture rye-grass is often cleaned out of wild white clover, and this is mainly of the long-lived type, dense at the crown, productive, and highly persistent. There is every indication that English old-pasture rye-grass and the Hawke's Bay rye-grass of New Zealand are equivalent forms; each is an aggregate of strains, and it is from within these old-pasture rye-grasses that the plant-breeder can isolate and fix strains which come even nearer to the pasture-plant ideal than do the aggregate strains as harvested from the old-pastures to-day.

The work of selecting the best strains out of English old-pasture rye-grass has been in progress for several years at the Welsh Plant Breeding Station. These strains have been multiplied and thoroughly tested on a wide range of soil-types, and there is no doubt of their superiority as pasture plants over other known lines. These pedigree strains are now being reproduced with a view to placing them in the hands of seed-growers, and it is hoped they will be available within a year or two. When supplies of these are procurable comparative trials as against the Hawke's Bay type will be extremely interesting here in New Zealand.

CONCLUSION.

In these days of permanent pasture, top-dressing, and management towards the rye-grass and white clover ideal, the presence of a rye-grass that can persist and respond to the treatment is more than half the battle. Practically all betterment of grassland, beyond a certain point, depends on the presence of a rye-grass that can respond. The true perennial rye-grass persists, and can withstand hard and starvation conditions for years. More rye-grass in the pasture means better winter carrying-capacity, and the possibility of shortening the low-production winter period of grassland by expensive nitrogenous manuring is largely dependent on the presence of rye-grass. Our aim in New Zealand is the "rye-white" ideal, and undoubtedly a big factor towards the perennial ideal of that ideal is the sowing of the best procurable strains to earmark ⁱⁿ these areas, ^{suc.}

(Series to be continued.)

CONTROL OF RAGWORT THROUGH INSECTS.

EXPERIMENTAL WORK WITH CINNABAR MOTH.

DAVID MILLER, Ph.D., M.Sc., F.E.S., Chief Entomologist and Director of Weeds Control Research, Cawthron Institute, Nelson

THE object of this article is to place before those interested a general account of the present position of the researches into the control of ragwort through the agency of insects.

In 1927 definite investigations into the possibility of controlling noxious weeds in New Zealand by means of insects were commenced at the Cawthron Institute.* At the outset it was decided to concentrate upon the four weeds of major importance--blackberry, ragwort, gorse, and pipiriri. In the case of blackberry, gorse, and pipiriri the investigations are still in the preliminary stages, but the work on ragwort has advanced to such an extent that field liberations of the cinnabar moth (*Tyria jacobaeae*), imported for the control of the weed, were made last autumn.

Although good results have been secured in other countries--e.g., in the control of prickly pear in Australia--the utilization of plant-feeding insects in the control of weeds, especially of weeds closely related to economic plants, is fraught with many dangers, in that there is always a possibility of the insects in question extending their food range beyond weeds to include agricultural crops. Under the noxious-weeds control scheme, and in order to guard as far as possible against this possibility, only insects that are known to be restricted to the weeds in question, or to plants of no great economic value in their natural haunts, are selected for importation to New Zealand. The insects are then kept under strict quarantine in special insectaries until the possibility of economic plants being attacked by them under New Zealand conditions has been thoroughly tested. If this proves negative the insects may be liberated in the field, as has been done in the case of the cinnabar moth.

It must be fully realized by the farming community that the liberations of the cinnabar moth already made were merely preliminary, and only a phase of an experiment to determine the behaviour of the insect in the field under its new environment. Farmers at the present stage must not be too optimistic concerning the control of ragwort by this insect, and must still actively continue to check the weed by cutting or by other means at their disposal, until it can be definitely shown that the insect will act as an efficient controlling factor. Unfortunately, too much publicity has been given to the possibilities of weed-control by means of insects; and any one believing that ragwort, or any other weed, will suddenly disappear as soon as an insect is liberated will stand

* During the first year (1927) the noxious-weeds control research was under the direction of Dr. R. J. Tillyard who initiated the scheme, and he was followed by the present writer in 1928. Mr. A. L. Tonnor, Field Entomologist, has been responsible for carrying on the researches since the inception of the scheme. Our thanks are due to Mr. A. H. Cockayne, Director of the Fields Division of the Department of Agriculture, for placing his field staff at our disposal in the distribution of the cinnabar moth.

to be deeply disappointed. The most that can be expected of any practicable means of control is to sufficiently check, but not exterminate.

HISTORICAL.

Of the several insects found attacking ragwort in Europe and Great Britain, the caterpillar of the cinnabar moth was selected as giving most promise as a means of controlling the weed in New Zealand. Its normal food plants are groundsel and ragwort, and in its natural haunts it sometimes occurs in epidemic form, when it clears large areas of the host plants. Furthermore, the insect is normally attacked by some nine or ten parasites, which tend to keep it from developing abnormally; but before it is liberated in this country these parasites are eliminated, so that the insect should have every opportunity of increasing to a far greater extent in its new environment than it would in its country of origin.

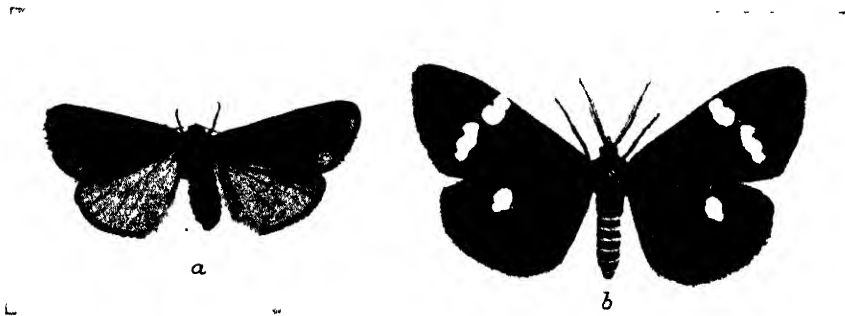


FIG. 1 (a) CINNABAR MOTH, (b) MAGPIE MOTH

[Photos by W. C. Davies]

As the caterpillars of moths pass through a dormant chrysalis or pupal stage before developing to the perfect insect, advantage of this was taken in transporting the cinnabar moth, the pupal period of which is a lengthy one. During the years 1927 and 1928 several consignments of the pupæ were secured by Dr. A. D. Imms, of the Rothamsted Experiment Station, and sent to New Zealand in cool store, and this method of transport has proved a success. An unsuccessful attempt was also made to send the eggs of the insect in cool store. From the pupæ, moths later developed in the quarantine insectaries at Nelson, and in due course a supply of caterpillars, used for carrying on the research, was secured from the eggs laid by these moths.

Although the cinnabar moth caterpillars are not known to attack plants of economic value in Europe or Britain, it was nevertheless necessary to submit the insect to a series of starvation tests in New Zealand before considering the question of liberation. Except in the case of ragwort, groundsel, and cineraria, these tests proved negative, and an official permit from the Government was given authorizing liberation. However, owing to later reports received from England, some doubt existed as to whether the larvæ would attack potatoes,

although the tests already made in Nelson had proved negative. In view of this, liberation in New Zealand was postponed until further and more detailed tests with potatoes had been carried out both at Nelson and at Rothamsted in England. These tests again showed that the insect could not survive on potatoes, and liberation was proceeded with.



FIG. 2. CINNABAR MOTH AT REST ON RAGWORT

[Photo by W. C. Davies

DESCRIPTION OF THE CINNABAR MOTH.

The moth (Fig. 1a), which measures about $\frac{3}{4}$ in. long when the wings are closed, is black in colour with crimson wing-markings; the forewings are black with a crimson stripe along the full length near the fore margin, and two crimson spots close to the outer margin, while the hindwings are completely crimson with a narrow black margin.



FIG 3 EGGS OF CINNABAR MOTH ON RAGWORT LEAF

[Photo by W. C. Davies.

The eggs are globular, and laid in clusters on the underside of the leaves of the food plant (Fig. 3); they are yellowish in colour at first, but turn to brownish in a few days.

The caterpillar (Figs. 4 and 5a) is distinctly marked with alternating broad blackish and narrow orange bands, and is sparsely clothed with long pale hairs; when fully fed it measures about 1 in. long.

The chrysalis or pupa (Fig. 5e) is rather plump and about $\frac{1}{2}$ in. long; it is more or less blunt at both ends, reddish to blackish-brown in colour, and is sometimes enclosed in a loosely spun silken cocoon.

LIFE-HISTORY.

Under summer conditions the eggs (each female moth laying about 150) hatch in about eight days, just prior to which they change in colour from yellowish to brownish. The caterpillars grow rapidly as they

devour the plants, during growth they pass through five stages, each stage being separated by a short quiescent period during which the protecting "skin" is moulted and replaced by a more roomy one to accommodate the growing insect. These moultings are accompanied by certain changes in colour. the minute freshly emerged caterpillar is yellowish except for the black head; in the second stage of growth (*i.e.*, between



FIG. 4 CATERpillars OF CINNABAR MOTH FEEDING ON RAGWORT

(Photo by W. C. Dutties)

the first and second moults) the colour is almost black, later turning to orange with black dots over the body; in the third stage (*i.e.*, after the second moult) the characteristic alternating orange and black bands make their appearance and persist through the fourth and fifth stages. The caterpillar takes about four weeks to complete its growth under summer conditions.

At first the young caterpillars are gregarious, feeding in colonies; but as growth proceeds they commence to wander and spread in all directions over the area covered by the food plants. Both leaves and flowers are devoured, the insect showing a preference for the latter. When fully fed the caterpillars do not burrow into the ground, but wander to some sheltered spot among the debris about the base of the

plants, or into crevices, or under lumps of earth or stones, where each may spin a very imperfect cocoon of silk, and there, passing through a final moult, transform to the pupa. The pupal stage is a prolonged one, and the insect passes the winter as such, the moths not emerging from the pupæ until the following spring.

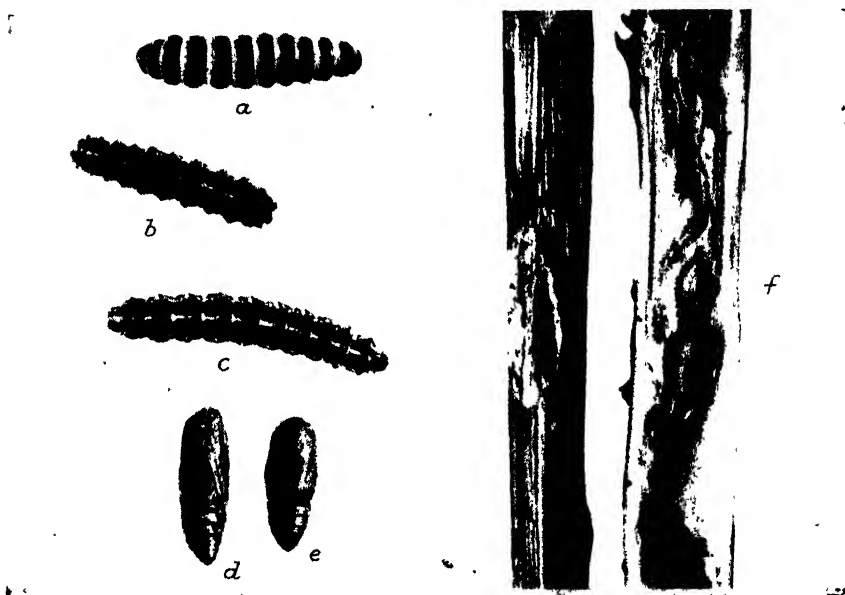


FIG. 5 (a) CATERPILLAR OF CINNABAR MOTH; (b AND c) CATERPILLARS OF MAGPIE MOTH (CLOTHING OF HAIRS INDISTINCT); (d) PUPA OF MAGPIE MOTH; (e) PUPA OF CINNABAR MOTH; (f) RAGWORT-STEMS DAMAGED BY MOTH STEM-BORER.

[Photos by W. C. Davies.

In Europe and Britain the cinnabar moth develops through only one generation each year, the moths appearing in the spring and during summer, when the caterpillars become abundant; in the autumn and winter pupation is at its height. Under New Zealand conditions it is hoped that two generations may develop, when the insect would certainly be a much greater factor in the control of ragwort.

LIBERATION OF THE INSECT IN NEW ZEALAND.

On 11th February, 1929, field liberations of the cinnabar moth in New Zealand were commenced, it being found most convenient to distribute the insect in the egg stage. In order to secure the supplies of eggs, fertilized moths were placed in muslin cages enclosing ragwort growing in the Cawthron Institute grounds (Fig. 6), and later the leaves upon which the eggs were deposited (Fig. 3) were removed and distributed in tin boxes. Altogether some 500,000 eggs have been

distributed at the following points: Cawthron Institute grounds, and in the Te Puke, Hamilton, Stratford, and Invercargill districts.

It was not intended that these liberations should be made to all ragwort districts of the Dominion, but only to selected areas, in order to ascertain the effect of the insect upon ragwort, and its manner of



FIG. 6. SHOWING MUSLIN CAGES USED IN CAWTHRON INSTITUTE GROUNDS IN SECURING EGGS OF CINNABAR MOTH FOR DISTRIBUTION

Photo by A. L. Tonnoir.

behaviour under field conditions where it would be exposed to the influence of its new environment. However, it is intended to make more widespread distribution of the insect next spring,* and with this in view a supply of several thousand cinnabar moth pupæ is expected to reach the Dominion in time for the liberations to be made. This supply is being secured by Dr. W. R. Thompson, of the Imperial Bureau of Entomology, London, who has now taken charge of the European end of the noxious-weed control work.

OTHER INSECTS ATTACKING RAGWORT.

In New Zealand there are at least five species of insects that, as larvæ, normally attack ragwort, but none of which actually serves as a sufficiently permanent means of control, though at times the weed may be temporarily checked by one or more of them. These insects

* Distributions will be made through Fields Division officers of the Department of Agriculture located in the different ragwort areas, and not direct from the Cawthron Institute to farmers.

are the magpie moth (*Nyctemera annulata*), two species of moth stem-borers (*Homoeosoma faranaria* and *H. vagella*), a fly pith-borer (*Agromyza* sp.), and a leaf-miner (*Agromyza affinis*).

The magpie moth and its black hairy caterpillars are common features of the countryside. As this insect has already been thought by many farmers to be the cinnabar moth, a description is given herewith. The moth (Fig. 1*b*) is somewhat larger than the cinnabar moth, and is black except for a pair of white or cream-coloured spots on the forewings, a single one on each of the hindwings, and orange-yellow bands on the abdomen. The globular eggs are placed on the underside of leaves, but, unlike those of the cinnabar moth, are pale-green at first, turning to yellow and finally to a leaden colour. The full-grown caterpillar (Fig. 5*b,c*) measures about $1\frac{1}{2}$ in. long; it is black with narrow brick-red lines along the body which is clothed with tufts of long blue-black hair, each tuft arising from a blue-black tubercle. When freshly emerged from the eggs the caterpillars are pale yellow in colour with a black head, and the body clothed with black hairs, while the tubercles supporting the hairs turn black after a few hours, giving a spotted appearance to the body. A few days later the yellow markings appear, and the characteristic features of the fully grown caterpillars become apparent. Winter is passed in the caterpillar stage. Before pupation a conspicuous cocoon of silk is spun, the caterpillars sheltering for this purpose in locations similar to those taken up by the cinnabar moth. The pupa (Fig. 5*d*) is about $\frac{3}{4}$ in. long, and more pointed at the posterior end than that of the cinnabar moth; it is yellowish at first, but later becomes blackish and mottled, the abdomen being conspicuously ringed with orange-yellow, though in older pupæ these markings disappear. The magpie moth may undergo three or four generations during the year.

The magpie moth is common every year, and periodically becomes epidemic, when it acts as a severe check to ragwort. However, these epidemics are not of sufficiently frequent occurrence to be of permanent economic value. One of the factors controlling this insect is that of parasites, there being two common species, *Ecthromorpha intricatoria* and *Phorocera casta*.

The two species of moths breeding in the stems of ragwort are well established throughout New Zealand; they occur also in Australia, and possibly in the Pacific islands. Some seasons they occur in localized epidemic form, when they act as temporary check to their host plant. Like the magpie moth, they are controlled by parasites. The damage they do to ragwort is shown in Fig. 5*f*).

The larvæ of the fly pith-borer and of the leaf-miner are usual associates of ragwort, but do but little appreciable damage, if any, to the plant.

PROSPECTS OF RAGWORT-CONTROL BY THE CINNABAR MOTH.

In the insectaries the devastating effect of the cinnabar moth was extremely apparent, and if this condition could be maintained each year in the field one could safely say that ragwort would no longer rank as a major weed. But under field conditions the insect enters a complex of factors any one or all of which might be so detrimentally

influential as to prevent it from maintaining a standard sufficiently epidemic for effective control. Among such possible detrimental factors are climate, natural enemies, and disease. Regarding climate, one should expect that the meteorological conditions of New Zealand would be rather favourable than otherwise, especially in the North Island; in Southland, on the other hand, the greater severity of the climate will probably have a staying influence upon the insect.

Of possible natural enemies predaceous and parasitic insects will certainly influence the problem. Even at this early stage of establishing the insect it has been found that the two parasites attacking the early stages of the magpie moth are both parasitic upon the cinnabar moth. To what extent these parasites will affect the general issue is not yet known.

The disease factor is not to be overlooked, since in the insectaries a polyhedral disease destroyed a very great proportion of the caterpillars. In the insectary, however, conditions were favourable to the development of this disease, owing to overcrowding and high temperature and humidity. It is hoped that similar epidemics will not destroy the cinnabar-moth caterpillars under open field conditions, although the writer has noted a somewhat similar disease destroying large numbers of the army-worm caterpillar (*Cirphis unipunctata*) during an outbreak of the latter.

NOTE.—The foregoing article will also appear in the *New Zealand Journal of Science and Technology*

IMPERIAL BUREAU OF SOIL SCIENCE.

THE Imperial Bureau of Soil Science (one of the eight bureaux the formation of which was recommended by the Imperial Agricultural Research Conference of 1927) commenced work on 1st May last at the Rothamsted Experimental Station. Sir John Russell, Director of Rothamsted, is also the Director of the Bureau, and Dr A. F. Joseph, lately Sudan Government Chemist, has been appointed Deputy Director. The functions of the Bureau include the collection and distribution of all research work on soils of importance to the British Empire; the assistance of research workers in the prosecution of their investigations in whatever ways the Bureau can give it, the bringing together (either by correspondence or in conference) of workers from different parts of the Empire interested in the same subjects; and the supply of information generally which may facilitate the work of soil experts in the development of agriculture.

It is hoped that before long the Bureau will be in close touch with all soil investigators of the Empire, both at home and abroad, and that by means of information-circulars and other methods the results of studies carried on in one part of the Empire will be made available for all. Arrangements will also be made to supply information dealing with soil investigations in foreign countries, the results of which (owing to language or other difficulties) are not readily available.

Certified Seed Wheat.—At last month's meeting of the Committee of the Wheat Research Institute Mr. J. W. Hadfield, Agronomist, Agriculture Department, reported that there had been a marked increase in the amount of wheat offered for certification, and that the standard required for certificate had been raised. An aggregate of almost twelve thousand samples of Tuscan and Hunter's wheat had been certified during the past season, and all of this had found a ready sale, so that a greater area than ever of standardized seed was being sown for the 1929-30 season.

MINERAL CONTENT OF PASTURES RESEARCH.

REPORT ON WORK IN NEW ZEALAND FOR YEAR 1928-29.

B. C. ASTON, Chief Chemist, Department of Agriculture.

Introduction.

THE following matter is the substance of an official report made by the writer in his capacity of Director of the New Zealand section of the research, supported by grants from the Empire Marketing Board, into the mineral content of pastures.

The work for the past year has provided additional evidence that where deficiency diseases in stock occur it is not possible to tell by mere inspection of the pasture whether it will or will not support stock in a healthy condition over lengthy periods, although stock may be kept healthy and even, under certain conditions, fattened if the period of grazing is restricted to a few months.

The three outstanding instances of this deceptive nature of the pasture are (a) "bush sickness," or iron starvation in sheep and cattle; (b) "dopiness" in sheep, or calcium starvation; (c) "Waihi" disease in cattle, or phosphorus starvation. (It is possible that this phosphorus deficiency may occur in sheep also in some localities.)

The "bush-sick" pasture has not only misled hundreds of practical farmers by its apparent normality and luxuriance of growth, but quite recently two eminent British authorities have failed to *see* anything abnormal in the appearance of the pasture.

The Mairoa "dopiness" pasture after treatment with a calcium salt is still a poor-looking feed, yet the addition of calcium has enabled a flock of young sheep to be maintained in health for eighteen months where previously the mortality would have been heavy.

Some cow-pastures in the upper Wairarapa district carrying a fair proportion of clovers and having good lime percentages are yet extremely deficient in phosphorus—none worse, indeed, has yet been found in New Zealand. Other areas are affording similar evidence but sufficient work has not been done to enable much to be said on the composition of their soils or pastures.

The remedy for each of the three troubles in stock mentioned is different, but it may be at once said that as all North Island soils are deficient in phosphate and give a liberal growth-response to phosphatic treatment, each of these deficiency diseases is benefited to a certain extent by phosphate dressings. Indeed, it would be an extraordinary thing if it were not so, seeing that phosphates have such a stimulating action on all plant-life—increasing the root-development and the consequent ability of the plant to search further afield for plant-food, and increasing the proportion of clovers in the pasture, thereby increasing the calcium content. Also it must not be forgotten that in the case of superphosphate other mineral foods besides phosphorus are supplied, chiefly calcium sulphate (supplying Ca and S), while in the case of basic slag there are supplied iron, manganese, silicon, calcium, and magnesium. All deficiency areas are therefore likely to respond to liberal phosphatic manuring, and

especially to treatment with a basic slag and superphosphate mixture in equal amounts. It may be noted that basic slag is the only commercial phosphate which contains iron in appreciable quantity.

There can be no doubt as to the correct method of combating deficiency disease under New Zealand conditions, where the deficient element would benefit both the yield or feeding-value of pasture and the health of the stock. In Waihi disease, therefore, undoubtedly treatment of the pasture by top-dressing with phosphates is indicated as sound policy, although to obtain quick results superphosphate in drinking-water, unsteamed bone-licks, and syrup of phosphate-of-iron drenches are for cattle undoubtedly efficacious remedies. In regard to calcium deficiency, there are cases where the application of lime or calcium salts does not increase to the same extent as phosphates the carrying-capacity of the pasture (Wallaceville experiments gave evidence to the contrary), yet it undoubtedly makes it more palatable and has a great influence in rendering stock more resistant to disease; therefore calcium salts or lime may well be advocated as a pasture-dressing. The administration of a lick to combat calcium deficiency is still in the experimental stage.

With regard to elements lack of which is responsible for malnutrition or deficiency diseases in stock, and which do not increase the yield and carrying-capacity of the pasture, such as sodium, iron, chlorine, and iodine, it seems probable that it will generally be found economic in cases where any such element is deficient for animal life to give it to the stock direct as a lick or drench, or dissolved in the drinking-water. It is doubted by some plant physiologists whether chlorine is essential to plant-growth, and the doubt about iodine must be greater still, seeing that all the elements known to be essential to plants have low atomic weights ranging from 1 (hydrogen) to 56 (iron), whereas the atomic weight of iodine is 127. Iron is required in such small amounts for *plants* that all soils, with very rare exceptions, contain sufficient, but the animal requires iron in much greater amount. It is an established practice in agriculture to give sodium and chlorine to the animal direct as a lick. It will therefore be both economical and logical to give iodine and iron as a lick in cases where it is desirable to supplement that of the food-supply. Indirect methods such as increasing the humus, thus reducing leaching and loss of plant foods, and supplying phosphates and nitrates containing the deficient element as an impurity, may when practicable be found effective.

One of the greatest difficulties met with in the progress of this investigation has been that of obtaining samples of pasture which adequately represent what the animal is actually eating. The most misleading results may be obtained from pasture gathered in the field on which stock are actually grazing. The tendency in the inexperienced sampler is to obtain samples of what the animal is *not* eating, for it is precisely that portion which is the most easy to obtain. Instructions have therefore been given to exercise the utmost care to collect only portions of pasture which shows signs of having been bitten by the grazing animals. While this task is likely to be satisfactorily accomplished with care in the case of cow pastures, it will probably be extremely difficult in the case of sheep pastures where the animals have the range over a large area of broken country and have reduced the area grazed to a very closely cropped lawn.

The writer hopes to evolve a system eventually that will enable proper samples to be obtained with certainty, but one of the first steps in attaining a reasonable degree of accuracy in this important part of the work is the delegation of the duty of all pasture-sampling to one officer and his assistant. Mr. R. E. R. Grimmett, of the writer's staff, has devised a special instrument for obtaining samples from short lawn-like pasture. This is merely a pair of horse-clippers with the alternate prongs removed, the sample being cut by applying the reverse side of the clippers to the surface of the soil. Some of the pastures in Central Otago are so bare in spring that even this device may fail and other methods have to be adopted.

It will be convenient to report the work undertaken during the year in the order given, disposing first of the investigations more recently taken up and which have at present only reached an initial stage, although it is possible that any one may develop into something much more important than the amount of work done would suggest.

Mortality among Sheep in Canterbury.

Mr. Grimmett visited various localities in Canterbury in September, 1928, and collected samples and information on an unusual mortality in sheep which had occurred there. The abnormal nature of the season—a warm and exceptionally moist autumn—had induced a copious growth of green rank pasture upon which the hoggets failed to thrive. A sample from Kowhai Bush was first received in June from the district Stock Inspector, and proved to be separable into two fractions—(1) a brown, long dead, and apparently inedible portion when collected and (2) a portion which was green, not long dead, and edible. The amount of portion (1) equalled 75 per cent., and that of portion (2) 25 per cent. of the whole. The analysis of the portions was done in duplicate, and the duplicates closely agreed as shown in Table 1

It will be seen that the calcium is comparatively high in both fractions, but there is a great disparity between the phosphoric acid content of the brown fraction compared with that of the green fraction. The brown fraction represents probably old dead leaves which had lived sufficiently long to have accumulated a large store of earthy contamination, hence the high manganese, iron, silica, and alumina content as compared with the green sample. The nitrogen in the brown portion makes a very poor showing for protein-supply. Altogether it was very much doubted whether the sample was a fair one of what the sheep were eating. It will also be noted that the dry dead portion contained less than one-half the phosphoric acid that the green portion contained, although the calcium content was little altered.

Mr. Grimmett reported as follows :—

It appears that mortality from parasitic gastritis and lungworm was fairly prevalent over most of Canterbury among hoggets and lambs during the autumn (1928), and that medicinal treatment had very little effect.

Districts specially affected were Springfield, Ashburton, Cheviot, and Methven, including both hill and plain country, heavy and light, and manured as well as unmanured land. The lower foothills and damp ground beneath them were, however, the worst. Nothing similar has

Table 1.—Analyses of Pasture, Kowhai Bush.

The figures are percentages on the moisture-free sample.

Constituents.	Portion 1.		Portion 2.	
	No. 6148, Dry A.	No. 6148, Dry B.	No. 6148, Green A.	No. 6148, Green B.
Total ash	9.88	..	11.34	..
Crude silica	5.66	5.65	3.57	3.56
Pure silica (SiO ₂)	5.54	5.52	3.51	3.51
Calcic oxide (CaO)	0.80	0.80	0.67	0.67
Phosphoric anhydride (P ₂ O ₅)	0.28	0.28	0.72	0.72
Ferric sesquioxide (Fe ₂ O ₃)	0.044	0.042	0.028	0.029
Magnesian oxide (MgO)	0.31	0.32	0.40	0.44
Manganoso manganic oxide (Mn ₃ O ₄)	0.070	0.066	0.036	0.041
Alumina sesquioxide (Al ₂ O ₃)	0.043	0.046	0.016	0.025
Nitrogen	1.30	1.30	2.95	2.96
Sulphur trioxide—present in crude silica	0.26	0.26	0.48	0.54
Ferric sesquioxide	0.0016	0.0014	0.0014	0.0011
Alumina sesquioxide	0.045	0.048	0.016	0.016
Calcic oxide	0.003	0.004	0.001	0.002

NOTE.—Explanatory details of procedure and technique followed in connection with analyses of pastures will be found in the issues of this *Journal* for January and February, 1928.

been said to have occurred for twenty years. It was generally stated that the past autumn was marked by an absence of drying north-west winds, and by a prevalence of drizzling rain and damp days, although rainfall was not above normal. In consequence, from March onwards there was an unusual lush growth of grass of a sappy nature, which went rank and to seed quickly. Lambs which had been grazing on high country in many cases during the summer were brought down to winter on this pasture, which included an unusual proportion of dead or dying growth of low nutritive value. Their condition was thereby weakened and they were an easy prey for parasites. In other cases the sheep had been on the place all the time, but it rapidly became understocked in relation to this rank autumn growth. In other cases, again, sheep were affected on turnips. The most effective treatment was a change to hard feed, such as feeding crushed oats on a bare paddock.

There is no doubt that the sheep did eat this rank growth, as the ground on F's property where M.'s sample was obtained is now bare and very hard grazed. No cattle have been grazing there, nor has it been burned.

In the Springfield district the three largest farmers who had trouble were F., J., and D. D. commenced feeding iodized salt liberally, and says it has cured the trouble. Nevertheless the trouble has now disappeared, with the exception of an odd case, on other farms where no iodine has been given. D. is very keen on the improvement caused by the iodized salt. F.'s sheep were brought down in the autumn from his station at Bealey, while J.'s were running on the lower slopes of Mount Torlesse before being brought in to turnips and the adjacent flats where the rank pasture was growing. F.'s property was originally southern-beech (*Nothofagus*) forest, and was felled and grassed thirty-five years ago. Since then it has been continuously stocked, and on the hill slopes has had no manure.

Table 2.—Analyses of Pasture Samples from Canterbury (Sheep Mortality Investigation).

The figures are percentages on the moisture-free sample.

Lab No.	Ash.	Crude Silica (SiO ₂)	Pure Silica (SiO ₂)	Ferric Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnesium Oxide (MgO)	Manganese Oxide (Mn ₂ O ₃)	Nitrogen	Proteins	Sulphur as SO ₂	Chlorine	Date collected	Manurial Treatment	Locality	Remarks.
6168	9.08	5.74	5.32	0.042	0.018	0.44	0.70	0.09	0.019	2.87	17.94	..	0.68	5/6/28	..	Kowhai Bush	Sheep affected. Short feed, eaten hard down.
6165	10.07	4.70	4.15	0.035	0.005	0.77	0.81	0.31	0.011	3.86	24.13	0.64	0.64	6/9/28	..	"	Sheep affected on old pasture; green new growth where grazed. Mostly fog, cockfoot, and creeping-tog; fair amount of red clover.
6166	8.37	3.08	2.88	0.033	0.054	0.85	0.79	0.39	0.052	1.35	8.44	..	0.18	7/9/28	Unmanured	"	Sheep affected; rank grass. Mostly fog, &c., as No. 6166.
6167	5.89	3.81	3.54	0.024	0.033	0.37	0.52	0.19	0.063	4.20	26.25	..	0.58	7/9/28	"	"	Mortality not noticed. Short green pasture, well grazed with cattle and horses as well as sheep. Contaminated with dirt by heavy flocking. Worm-casts very plentiful. Cockfoot and fog dominant.
6168	9.53	3.66	3.20	0.082	0.135	0.94	0.77	0.37	0.050	1.24	7.75	..	0.28	7/9/28	..	Near Burnham	Old stubble field where foggets look ill after three months. Poor pasture—nearly all hair-grass with, brown-top, and fescue; no clover; Scotch thistles in poor dry, stony soil. Foggets still grazing among boggets.
6169	8.38	6.47	5.13	0.041	0.054	0.22	0.29	0.20	0.030	2.43	15.19	..	0.43	7/9/28	Unmanured	Between Darfield and Springfield	Mortality among boggets. Swamp paddock, fescue of grass; alhaval flats near stream; mostly brown-top and twitch.
6170	8.58	5.11	4.51	0.038	0.048	0.12	0.51	0.32	0.092	3.53	22.66	..	0.90	7/9/28	2 cwt. super in 1927	Ditto	Mortality. Swamp paddock, well grazed; mostly young fresh growth—brown-top, white clover, &c.
6171	9.76	3.19	2.93	0.071	0.098	0.80	0.75	0.50	0.066								

Samples (except No. 6168) collected and analysed by R. E. R. Grimmel

NOTES.—It will be seen that the phosphoric acid and lime contents of No. 6169, from where the hoggets became affected is exceptionally low. No. 6167 is little better, while No. 6168, from where no mortality was noticed, contains much higher amounts of both the constituents mentioned. The high alumina content of several of the samples shows that they were contaminated by earthy matter. It must not be forgotten that, except No. 6168, all the above are early spring pastures.

Yet the grass still keeps a fairly good heart, and F. states carries two sheep to the acre all the year with the help of hay and turnips. Both F.'s and J.'s properties are partly on alluvial terraces and partly on hill slopes of residual soil from greywacke rock, which outcrops, forming screes. The soil is loamy, with a loamy, clayey, or rocky subsoil. The pasture is mixed, and varies from place to place. Tussocks are abundant, but between is a good sole of cocksfoot, brown-top, fog, fescue, &c. White clover is present, and is said to be fairly abundant during the summer. There is moss in places, but the property is 1,200 ft. above sea-level.

The results of the analyses of Mr. Grimmett's samples are presented in Table 2. Readers in the Northern Hemisphere must remember that in New Zealand, where the seasons are reversed, June is midwinter.

Temporary Sterility in Dairy Cows, Waikato District.

Mr. Grimmett visited the Waikato in October, 1928, and in company with Mr. C. M. Wright, Country Analyst, and Mr. C. V. Dayus, Veterinarian, collected samples of pasture from typical farms upon which temporary sterility in dairy cattle occurred, and also from farms apparently similarly circumstanced upon which no sterility occurred. The results (Table 3) do not show any constant chemical difference in the pasture of the two types of farms. The high protein content of the pasture of all the farms is notable.

These Waikato samples seem to indicate that low lime content follows low legume composition. The protein content is generally high, and in some cases very high. The majority of the samples are obviously contaminated by soil, as shown by the high alumina content, the only samples showing any approach to freedom from this impurity being Nos. 6192 and 6195. The iron determination must therefore not be accepted as representing the analysis of the pasture tissue.

Malnutrition on certain Poverty Bay Back-country Pastures.

The few analyses made of the Poverty Bay back-country pastures (Table 4) give evidence of both iron and calcium shortage for these early spring pastures; summer pastures would contain more calcium. Mr. Grimmett, who has paid two visits to this area, which is remote from headquarters and difficult of approach, has put forward a very ingenious explanation to account for the occurrence of this type of malnutrition under conditions which do not accord with past experience. It appears that on the same farm there are two types of country—flat tablelands overlain by pumice showers, and steep papa slopes and gullies from which the pumice has been washed. or, at any rate, so mixed with clay that a loamy soil results. When cattle and sheep were grazed together the cattle kept the steep slopes and gullies free from scrub, fern, and "second growth," and enabled the sheep to graze on land with the cattle and thus balance their mineral diet. Grazing by cattle becoming unprofitable, it was discontinued, with the result that the gullies became blocked by tall woody growth or bracken-fern, the sheep were excluded, and thus, the means of balancing their mineral ration denied them, the malnutrition appeared. A scheme of experiments has now been laid down which will determine whether top-dressing will overcome, as seems probable, the difficulty, which is one that does not occasion any anxiety as to the ultimate successful utilization of this fine country.

Table 3.—Analyses of Pasture Samples from Waikato District (Temporary Sterility Investigation).

The figures are percentages on the moisture-free sample.

Lab. No.	Ash.	Crude Silica (SiO ₂)	Pure Silica (SiO ₂)	Ferric Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnesian Oxide (MgO)	Manganese Oxide (Mn ₂ O ₃)	Nitrogen	Proteins	Grasses.	Legumes.	Weeds.	Date collected.	Manurial Treatment.	Locality.	Remarks.
6186	10.74	2.24	2.07	0.035	0.122	1.03	1.20	0.53	0.032	4.71	29.4	71.3	24.8	3.9	5/10 '28	Previous years, super, slag, and potash, 1927, 4 cwt, super per acre 1928, 4 cwt super 1 cwt sulphate of ammonia	Hairini, Te Awamutu	Sterility 40-50 per cent. of herd. Old grass paddock; short feed. Undulating country. Subterranean and white clover, trefoil and rye-grass dominant.
6187	11.22	2.51	2.34	0.046	0.156	0.95	1.20	0.49	0.030	4.23	26.4	64.1	25.0	10.6	5/10 '28	Manured annually for last six years with 2 cwt. super, 2 cwt lime, and a little potash salts	Hairini, Te Awamutu	No sterility. Good short pasture—white clover and trefoil dominant. Grazed by cows. Fifteen years in pasture. Undulating country.
6188	11.17	2.57	2.35	0.060	0.201	0.89	1.18	0.51	0.023	4.33	27.0	63.1	30.2	6.7	5/10 '28	June, 1926, Clark's Favourite mixture April, 1927, 2 cwt. super, 1 cwt. potash. May, 1928, slag, super, and potash, 4 cwt.	Hautapu...	Good deal of sterility. Old grass paddock. Subterranean and white clover, trefoil, cocksfoot, rye-grass, and timothy dominant.
6189	11.07	2.05	1.88	0.049	0.184	1.05	0.91	0.36	0.019	4.49	28.1	76.1	15.0	6.9	5/10 '28	2½ cwt. super and guano, equal parts, for some years February, 1928, 4 cwt lime March, 1927, 3 cwt super March, 1926, 2½ cwt. slag, ½ cwt kamit	Hautapu ..	Practically no sterility. Long grass grazed by cattle. Rye-grass dominant.
6190	10.48	2.06	1.89	0.131	0.323	0.32	0.98	0.48	0.045	1.76	23.5	82.8	15.9	1.3	5/10 '28	March, 1927, 3 cwt super March, 1926, 2½ cwt. slag, ½ cwt kamit	Koromatua	Great deal of sterility. Unlimed, low, swampy paddock; four years old. Long growth; grazed by cows; rye-grass dominant.
6191	12.17	3.04	2.80	0.062	0.344	0.90	1.16	0.41	0.031	3.02	22.6	85.1	12.6	2.3	4/10 '28	Super and lime, slag and kamit, alternate years, 3 cwt August, 1928, 1 ton ground limestone	Koromatua	Limed paddock, low-lying and swampy; ten years old. Cows grazing. Close cropped, and dirtier than No. 6190.
6192	12.15	2.53	2.44	0.030	0.113	1.02	1.08	0.48	0.036	4.31	27.1	81.2	14.9	1.0	4/10 '28	Recent years slag, super, and kamit, 3 cwt 1928, 3 cwt. super and some White Island product	Matangi ..	Rye-grass dominant. Little sterility. Unlimed Ten years in grass; cocksfoot dominant.
6193	11.57	2.38	2.25	0.042	0.080	1.00	1.11	0.45	0.018	4.26	26.6	77.4	20.2	2.3	4/10 '28	Similar to No 6193, but limed	Matangi ..	Limed paddock; rank and luscious growth; cocksfoot, rye-grass, trefoil, and white clover dominant.

6194	10-54	2-52	2-33	0-082	0-198	0-77	0-71	0-15	0-173	1-11	25-7	0-9	6-5	1-0	6	10	28	Top-dressed once with 3 cwt super, once with 3 cwt super and guano, twice with 4 cwt slag. No top-dressing, 1928	Orni. Taupiri	Great deal of sterility, vaginitis, abortion, and bone-coring. Swampy paddock, clay soil on peat. Fog, rye-grass, and timothy dominant. Six years in grass
6195	11-50	3-11	2-83	0-029	0-066	0-96	0-55	0-60	0-612	4-13	27-7	0-21	5-1	2-8	6	10	28	Never top-dressed nor limed	Orni	No sterility, but some abortion. Peaty soil, stunted by sheep between heavy growth of rushes. Fog, rye-grass, cocksfoot, timothy, Poa pratensis dominant.
6196	12-10	3-16	2-94	0-048	0-108	1-06	0-81	0-40	0-036	4-33	27-0	0-09	7-2	1-0	6	10	28	Top-dressed annually with lime and super (2:1), 3 cwt; and last two years, biannually with 2½ cwt basic slag	Tauhei (on Taupiri-Morrisville road)	Eclampsia badly in 1928. Down to pasture fourteen years. Rye-grass dominant. Undulating country.
6197	10-01	2-12	..	..	..	1-06	0-65	..	0-037	3-14	21-7	0-8	0-9	6-3	6	1	28	Lime, super, and basic slag annually, 1928 basic super and blood-and-bone. Last autumn, 1 cwt No 1 White Island product and 2 cwt basic super	Tauhei	Undulating country. Cropped for hay last five years. Mostly meadow-foxtail in flowering stages
6198	12-99	3-61	3-42	0-063	0-215	1-16	0-56	0-16	0-032	4-01	25-1	0-8	0-7	0-6	6	10	28	Top-dressed annually: last seven years with lime and super	Tauhei	Eclampsia experienced. In grass eighteen years. Long rank growth, grazed by cows. Mostly rye-grass, meadow-foxtail, timothy, cocksfoot, fog. Poa pratensis, and brown-top.
6199	12-75	2-33	2-26	0-037	0-073	1-45	1-06	0-40	0-023	4-87	30-1	7-10	1-8	7-6	6	10	28	1927, super and slag, plus 8 cwt lime 1928, 3 cwt super	Waharoa Downs	Sterility moderate: rolling downs, Poa pratensis, cocksfoot, and rye-grass dominant. Virgin beath country.
6200	11-50	2-36	2-18	0-019	0-113	1-21	1-21	0-53	0-035	4-63	28-9	6-9	7-5	5-1	6	10	28	Manured annually, 3 cwt super 1926, 4 cwt lime, October, 1928, 3 cwt super	Waharoa Downs	No sterility. Low flat country. Good short feed. Rye-grass dominant. Down six years.

Samples collected by R. L. R. Grammett and analysed by I. J. Cunningham

The figures are percentages on the moisture-free sample.

Lab. No.	Ash.	Crude Silica (SiO ₂)	Pure Silica (SiO ₂)	Ferric Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnestic Oxide (MgO)	Manganese Oxide (MnO ₂)	Chlorine (Cl)	Nitrogen	Proteins	Grasses	Legumes	Weeds	Date collected.	Manurial Treatment.	Remarks.
6215	11.96	1.87	..	0.050	0.157	1.13	1.87	..	0.006	0.82	1.72	29.5	43.6	49.4	7.0	23/10/28	..	Medium growth; weedy pasture. alluvial flats. No deficiency disease.
6216	11.00	3.93	3.76	0.022	0.092	0.85	1.20	..	0.035	0.70	3.44	21.5	71.2	24.3	4.5	25/10/28	Unmanured ..	Old pasture; deep pumice soil on terrace above papa slopes. Hair-lessness in calves (not hereditary). Iodine deficiency suggested. Sample showed 58% iodine per 1000 parts of dry matter; below average in iodine matter; below Cockfoot and fog dominant.
6217	10.97	2.71	2.63	0.017	0.034	0.94	0.68	0.48	0.019	0.94	1.31	30.7	89.3	6.8	1.9	26/10/28	Not top-dressed	New bush-burn, seven years old. Best country on the place. Sick sheep recovered on here.
6218	10.28	3.10	3.03	0.017	0.022	0.81	0.74	0.45	0.024	1.18	3.71	23.2	94.1	2.0	3.9	26/10/28	..	Bush burned twelve to fourteen years ago; pasture beginning to run out. Cockfoot, fog, and ryegrass dominant. No sickness yet, but sheep do not recover quickly here.
6219	9.92	3.98	3.86	0.016	0.067	0.66	0.75	0.38	0.018	0.85	3.27	20.4	91.9	2.0	3.1	28/10/28	Unmanured ..	Most sick paddock on the farm. Well watered with streams and gullies, but there is full of second growth scrub, mainly fern, etc. Cock- foot dominant, with a few pen- tiful and pipiri common.
6220	9.06	2.94	2.84	0.015	0.059	0.67	0.77	0.41	0.032	0.85	3.54	22.1	91.4	4.1	1.4	28/10/28	..	Felled and grassed eighteen years. English grasses nearly all re- placed by Chewings fescue. Very sick for sheep. Lower gentle slopes and flats near river deeply covered by pumice; swamps and creeks filled with rushes, &c.
6221	12.83	4.36	4.25	0.018	0.045	1.01	0.87	0.51	0.032	0.97	4.15	25.9	94.7	3.4	1.8	28/10/28	..	From faces and slopes, pumice- covered, outcrops of sandstone bog, creeping fog, and Chewings fescue dominant in that order. Very rich paddock, originally southern beech forest.
6222	11.80	3.57	3.46	0.018	0.064	0.92	1.06	..	0.028	1.08	3.80	23.8	87.5	7.6	1.6	28/10/28	..	Possibly sick. Down twenty years. Cockfoot, ryegrass, and fog dominant. Originally rimu-tawa forest.

Samples collected by R. E. R. Grimmett and analysed by P. H. Sykes, Iodine determination by Miss Simpson.

(To be continued).

PACKING OF BUTTER FOR EXPORT.

G. M. VALENTINE, Dairy Factory Superintendent, Massey Agricultural College, Palmerston North.

THE packing of a box of butter would seem to be a very simple operation, but the number of complaints received from overseas buyers indicate that there is room for much improvement in the work.

A considerable proportion of the butter exported is cut into pats with wire cutters by the retailer, and unless the block when turned out is square at the corners and free from pockets much recutting is necessary, for which the conveniences are not always available. Butter which comes in contact with the parchment usually has a slight woody or stored flavour, and may be a shade different in colour in comparison with the inside of the block; consequently it is a great advantage to be able to cut fifty-six pats from a box without waste. This can be done with wires which cut four layers of 14 lb. each, and only check-weighing is then required. This may appear to be a small matter to the person packing the butter, but it is quite important to the one who has to deal with it at the other end.

For the same reason the exact standard-sized box should be used by all factories. It must be apparent that a machine which is made to cut a block of butter $15\frac{1}{8}$ in. by $10\frac{1}{4}$ in. by $11\frac{1}{4}$ in. will not cut one $14\frac{1}{4}$ in. by $10\frac{1}{2}$ in. by $11\frac{1}{4}$ in. without much waste. A certain amount of inconvenience also arises at this end of the trade in machine packing where the boxes are not uniform in size. A case has been known where a factory had three makers' boxes in use, and all of them different sizes. When the shooks get mixed in such an instance the confusion can be imagined. Surely this is a matter where absolute standardization is called for.

PAPERING THE BOX.

Good packing starts with the papering of the box. Unless the paper is correctly creased and tucked into the corners the block of butter when turned out will have rounded corners. Carelessly placed end papers, for instance, will either cause a rounded end corner or the paper must break when the pressure of the machine comes on to it. The first piece of butter put into the box binds the two overlapped end papers. As the pressure comes on, the butter squeezes hard against the ends, thus locking the paper in two places. The result is as stated—a rounded end corner or a broken paper.

The aims in dressing a butter-box are to have a double thickness of paper covering the butter at every point; to have no surplus paper at any part of the box; to have an overlap at every joint; to have a neat attractive appearance when the box is opened up and the butter turned out; to have a dressing which will allow of the butter being inspected by the grader or buyer, either at top or bottom, without lifting more than one piece of paper; and, finally, to have a block of butter which, when stripped, will have square corners and be free from pockets.

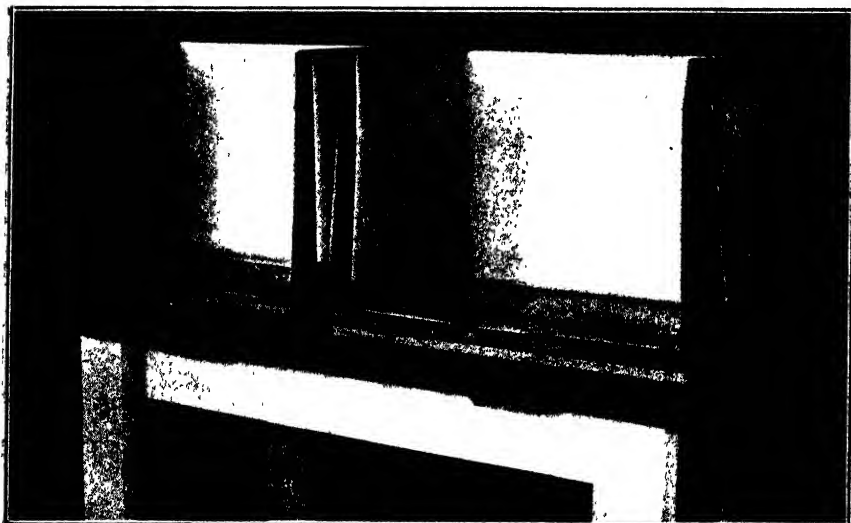


FIG. 1. TWO METHODS OF PAPERING A BUTTER-BOX

(a) On left : The cross-over method. Note the rounded corners and uncovered wood on back corner at weakest part of box.

(b) On right : The envelope method. Square corners ; no tucking required ; no exposed wood.

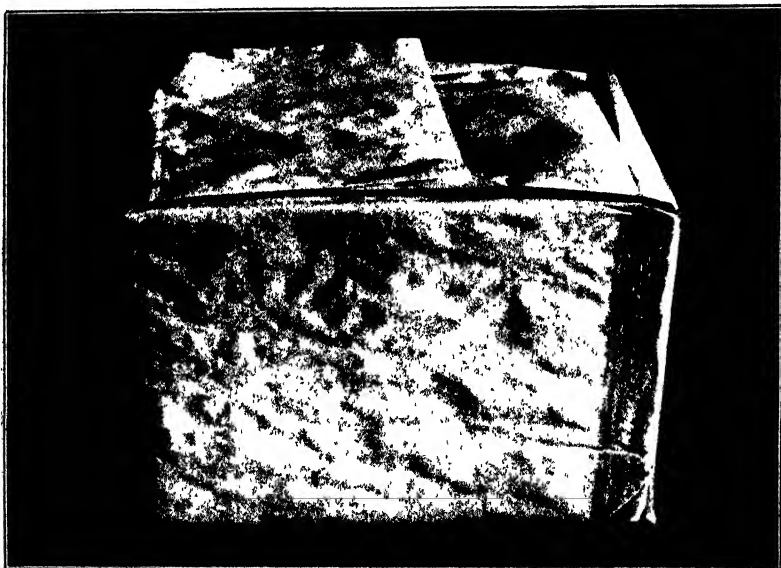


FIG. 2. BLOCK TURNED OUT OF BOX BADLY DRESSED BY CROSS-OVER METHOD. Note single parchment at corners, and loose ends, giving an untidy appearance.

The Cross-Over Method (Fig. 1a).

Taking 20 in. by 30 in. as the standard sheet of parchment, and remembering that the standard box is $15\frac{1}{2}$ in. long by $10\frac{1}{2}$ in. to $10\frac{3}{4}$ in. wide and $11\frac{1}{4}$ in. deep, inside measurements, it will be seen that a plain fold and cross-over method of dressing does not allow sufficient paper to completely cover the butter. It can be accepted that there is only one way to fold the end papers, and that gives a double sheet 30 in. long by 10 in. wide. One can also agree that it is the best practice to put these sheets in first. To allow a lap of 2 in. in the bottom, crease the end papers by folding at $9\frac{1}{2}$ in. from one end. A number of sheets can be folded at one time, and if a block of wood is used to impress the crease it will be found that the paper sits closely into the corners of the box. If this is not done a rounded corner will result, as previously explained, especially with machine packing, where the papers are prevented by the clamps from slipping down. When folded over on the top of the butter it will be found that there is about the same amount of lap there.

The paper being now folded the opposite way gives a double sheet 20 in. by 15 in., which, if placed in the side in the same manner as the end, cannot possibly be made to completely cover the butter at the corners and provide a lap, as shown in Fig. 1a. At tops and bottoms, however, there will be an unnecessary lap of over 4 in., giving four thicknesses of parchment over nearly the whole of the butter. To overcome the lack of lap in the corners it is a practice to fold short, thereby getting a sheet 20 in. by 16 in., which gives a short lap in the corner. Since 2 in. of a sheet folded in this manner must be single, it follows that a portion of the butter in two corners must be covered with only one thickness of paper (Fig. 2). When the box is opened up these two methods give a most untidy package, and at least two sheets must be lifted in order to examine the butter. The only thing that can be said in favour of the cross-over method is that it is quick.

The Envelope Method.

By placing the 20 in. by 15 in. sheet in the box in the opposite way over 2 in. of lap can be obtained in the corners, $\frac{3}{4}$ in. in the bottoms, and 3 in. at the top. (Fig. 1b.) There are many variations of this method, but it is undoubtedly superior to the cross-over method, however it may be done. Probably the most common practice is to fold over the corners at the top of the sheet and tuck the bottom corners. Neat tucking is seldom seen, however, and the result is an untidy bunch of crumpled paper, which is very unsightly when turned out. To save the time in folding the corners, and the necessity for tucking it is better to cut both these corners off; and if the sheet is folded unevenly in the first place, as shown in Fig. 3, there will be more lap available at the bottom and sufficient at the top for the packing-machine clamps to grip. The short side of the folded sheet is placed against the butter in this case. The longer side will then overlap it, and also adhere to the butter, leaving no loose ends (Fig. 4).

Boxes dressed in this way will conform to the requirements previously stated, and when the butter is turned out the whole of the paper will be adhering to it, and present no difficulty if the box has to be put back on to the block of butter, as there will be no loose ends.

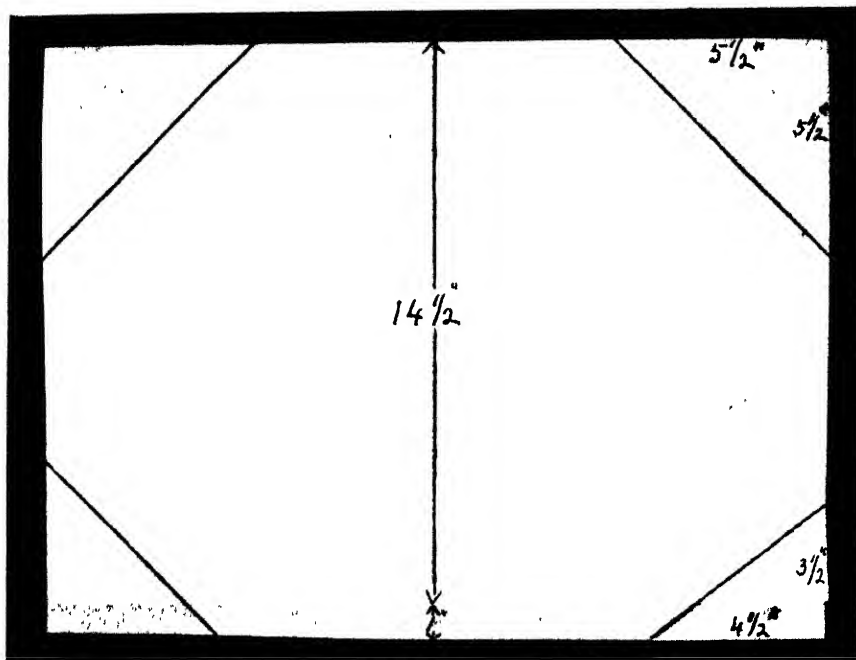


FIG 3 SHOWING ARRANGEMENT OF PAPER FOR ENVELOPE METHOD
Side papers folded short Corners to be cut off on lines drawn in diagram

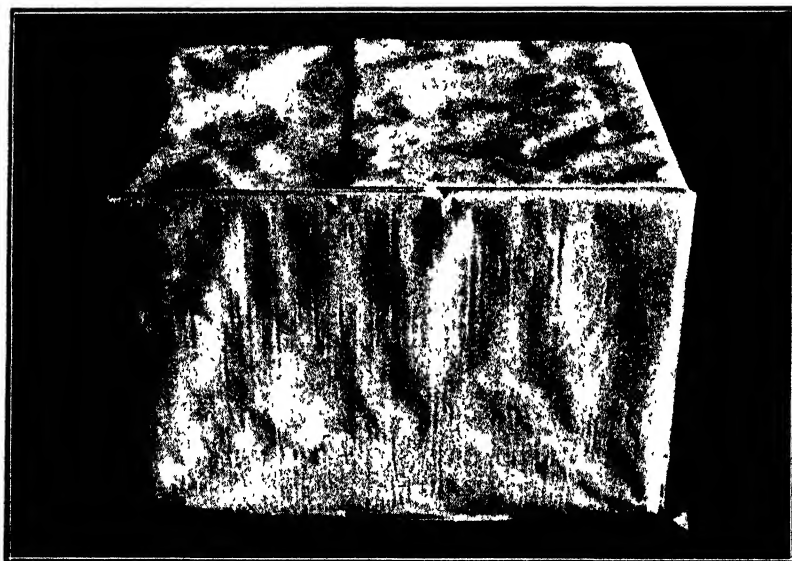


FIG 4. BLOCK TURNED OUT OF BOX WELL DRESSED BY ENVELOPE METHOD.
Note double parchment over all surfaces, and no loose ends.

The measurements may require to be adjusted to suit boxes of a certain size. The cutting of such an amount of parchment entails much waste, but this is justified by the time saved and the neat result attained. Too much paper always makes a poorer parcel than just enough, and there is no reason why parchment for butter-packing should not be cut by the makers into the shape required, and so save the labour of all folding. The cube box was dressed with a 12 in. by 48 in. sheet, and if double parchment was required one sheet was put round the four sides on its edge and no cutting or folding was required.

The best method to follow if cutting the sheets in this manner is to make a wooden gauge the size of the folded sheets. Stack the sheets on a bench and place the gauge on top, then cut off the corners with a sharp knife, or with a hammer and a broad sharp chisel.

Finished boxes dressed by the two methods described are shown in Figs. 5 and 6.

One of the earliest methods of dressing butter-boxes was to have envelopes made which just fitted the box and from the packer's point of view they were very satisfactory. The drawbacks were the expense and the difficulty of finding a paste that would not develop mould. It was also found that two thicknesses of parchment gave better results. Should the packing-machines now on the market—which mould the block of butter in the same way as a pounder shapes pats—be successful, these envelopes may again come into use.

It may be remarked here that the general care of parchment in factories leaves room for a good deal of improvement, and should receive more attention, even if only as a safeguard against butter-moulds. The cover should be left on the opened ream while it is being used, and if mould trouble occurs the parchment should be soaked in brine-formalin solution.

WEIGHING.

Butter which has been churned at a low temperature and has been lying on a table long enough to set presents no little difficulty in cutting it into pieces of convenient size for packing. Much labour can be saved by cutting with a wire across the rolls in lengths to suit the box. This can be done either on the table or by laying the wires across the unloading-truck before it is run into the churn. The old method of weighing the empty box, filling it with butter, and then reweighing is now seldom seen. Experience has shown that more accurate weights are obtained by weighing the butter before packing.

A careful man at the scales is a valuable employee, and the check weighings from some factories would be a revelation to others not so fortunate. Although scales of a very old type which have seen over twenty years' service are in use to-day in some factories, no fault can be found with their weights.

Provided two correct 56 lb. weights are available, or even one in some cases, any scale can be adjusted to weigh off 56 lb. of any commodity correctly, even if they are incorrect at other weights. Having adjusted the scale, it is then only a matter of care to keep the weights right. Admitting that the amount at stake warrants the provision of the best of appliances, expensive appliances do not ensure correct work unless care is taken in using them. The man doing the work counts for more than an elaborate scale.

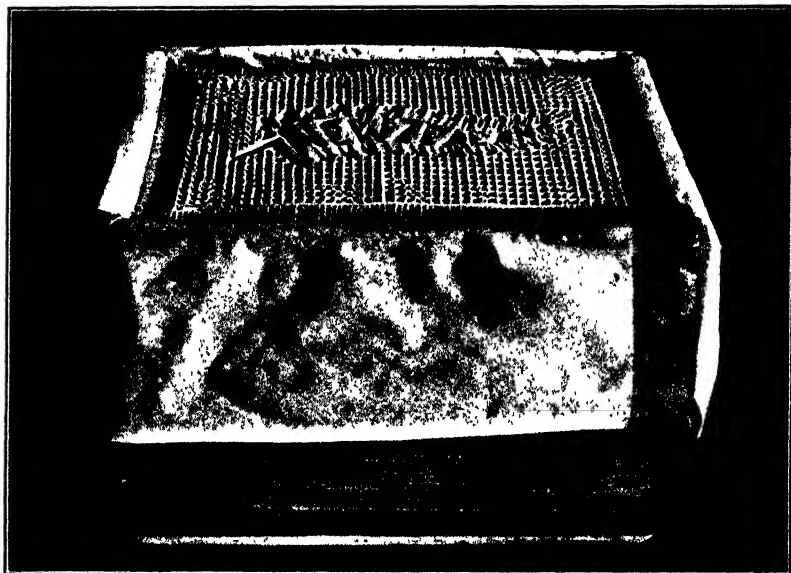


FIG. 5. BADLY-DRESSED BOX (CROSS-OVER METHOD), SHOWING A POOR FINISH.

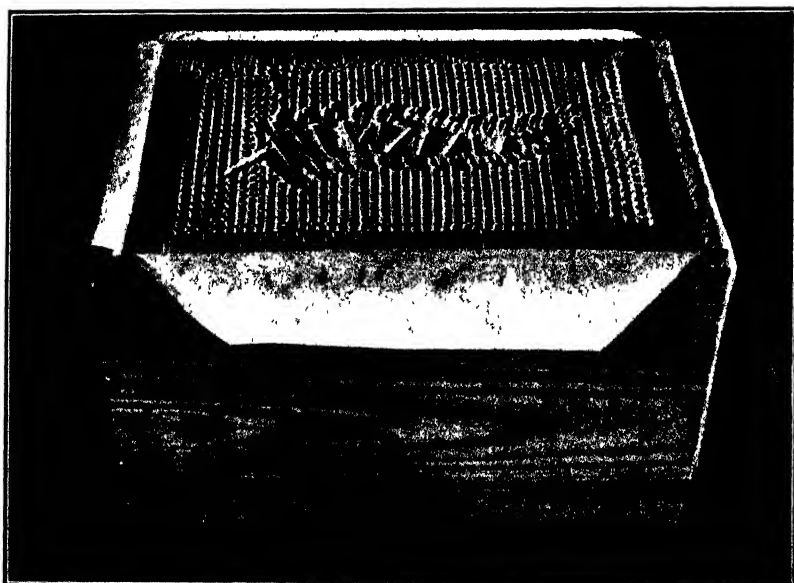


FIG. 6. WELL-FINISHED BOX, CORRECTLY PAPERED BY THE ENVELOPE METHOD.

Many mistakes in weighing are the result of butter sticking to the scale-platform. This can be avoided by covering the platform with a damp sheet of parchment.

PACKING THE BUTTER.

Where large numbers of boxes are being packed by hand—an unusual case nowadays—a solid bench with a clamp or wedges will save a lot of trouble and get over the very serious objection of putting the ends in first when hand-ramming, as it will hold the side papers in position and leave both hands free to handle the rammer.

The greatest mistake in packing, either by hand or machine, is putting too much butter into the box at a time. The misguided efforts of packers to put 56 lb. of butter into a box in one piece indicate that they have not a grasp of their work. The butter should be divided into at least three pieces, and be roughly moulded to the shape of the box. Ram carefully round the sides, especially the first piece, paying special attention to the corners. If the first piece is not rammed solid no amount of ramming of the second piece will make it so.

Machine packers have now come into almost general use, largely as the result of the firm body generally aimed at by New Zealand butter-manufacturers. They save a lot of hard work, and if used intelligently make a better job than average hand packing. As at present constructed they leave considerable room for improvement in their design.

The greatest weakness of the machines is the want of provision for easy adjustment of the thrust. Every one who has handled butter knows that, in common with other substances, its volume varies with its temperature. The packer should therefore be adjustable to allow of the thrust being set to suit the condition of the butter. Except in those factories which pack for city trade, where the pounding is done with wire cutters, the pressure on the machine is generally too light, and consequently pockets are left in the butter. Butter in the condition in which it is packed—that is, before it sets—has considerable elasticity and allows quite a margin for the pressure which may be exerted on it. As at present constructed the only way to increase the pressure is to remove the head and place a piece of board between the wood and the casting. If the wood is placed under the box it raises the latter too high, and the hoppers will be out of alignment and will not fit down into the box, while the head will jam as it comes down.

A little experimental work will show the pressure necessary to ensure good packing. A box-lid may be cut to fit the hopper, and placed on top of the butter in the hopper, after which the packer is set in motion. The butter is then turned out on to a table and shows whether it is well packed. If not, a thicker piece of wood may be tried.

As with hand packing, it is a mistake to put the butter into the hopper in one piece. It should be cut into at least three pieces, and care should be taken that the last piece is the largest and presents a smooth surface to the head of the packer. This will give a good finish requiring very little smoothing off by hand. Care should also be taken that all the butter belonging to the box goes into it.

The Benhil butter-moulder, at present used in the Waikato, introduces a new method. Its construction is similar to that of the pounding-machine by the same makers. In a box, the front portion of which is covered, there are two spindles. On the spindles are mounted two spiral flanges, one a right spiral and the other a left. The butter is placed in the open portion of the box, and the action of the flanges forces it out through the opening in the front of the box on to rollers, where it is cut off with wires in the same way as pound pats are cut. The rollers are then lowered to the level of a second section of rollers on the scales on to which the butter is conveyed. Here the weight is adjusted and the butter passed on to a third section of rollers, where the parchment, already suitably cut, is placed on the block of butter—the sides first and then the ends. The block is slightly smaller than the box, which is now slipped on to it, turned over, and finished in the usual way. The size of the block can be adjusted and the machine controlled in the same manner as a pounding-machine. Provided the butter is in proper condition, the block as turned out is square on the corners and free from pockets, and with ordinary care the weights should be correct.

FINISHING.

Assuming that the box is always opened at the top (which is not always the case, and therefore the bottom is equally important), the impression given by the appearance of the package when the lid is lifted will always be favourable or the reverse and have a bearing on the attitude of the buyer. A slovenly finish will incline the buyer to assume that the same carelessness has been displayed in manufacturing the butter and that the quality corresponds. Corners not filled, or an uneven surface on the butter, will indicate to him that the butter will not cut up well.

Having filled and rammed the box, smooth off with a trimmer, not with a pat, and roll with the National brand roller. Wipe the top edge of the box with a damp cloth to remove any pieces of butter, and fold over the side papers, then the end papers. By following this order an end paper may be lifted to examine the butter without disturbing the rest of the covering.

WEATHER AND WHEAT YIELD IN CANTERBURY.

SUMMARIZING in the *Journal of Science* a recent study of the relationship between the various meteorological factors and the wheat yield at Canterbury Agricultural College over a period of years, Dr. F. Kidson, Director of Meteorological Services, advances the following tentative conclusions:—

- (1) The weather variations in winter are responsible for only very slight variations in the wheat yield; cool and dry conditions are probably favourable.
- (2) In spring and summer warm and moist conditions are favourable, especially in the growing-period, but considerable losses may be caused by heavy rain in February.
- (3) There seems to be little prospect of making a useful crop forecast any considerable time before harvest, since conditions in the period immediately preceding the cutting of the crop have the greatest influence on the yield.

LIVE-STOCK DISEASES ASSOCIATED WITH CALCIUM DEFICIENCY.

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Lincoln

THE importance of calcium as an addition to the food of animals does not seem to have been fully appreciated in New Zealand, though there arrive periodically from outside sources reports that some disease or other is caused directly or indirectly by a calcium deficiency.

Since the feeding of calcium, either as lime or as bone-flour, is inexpensive (the cost of feeding a dairy cow 2 oz. per day, which amount has been found beneficial by Linton⁽¹⁾, for one week being just over 1d.), it is surely worthy of trial. In this manner for a very moderate outlay each farmer can experiment for himself, with the assurance that if no benefit be derived certainly no harm will ensue. From another point of view this could be commended, since the fodder on different farms and even on different paddocks varies in its calcium content.

Probably of the diseases claimed to be associated with a calcium deficiency milk-fever is of premier importance to the New Zealand farmer. Within recent years Dryerre and Greig⁽²⁾ have found that cows suffering from this disease have a deficiency of calcium in their blood, probably due to the large amount of this substance in the colostrum or first milk. In support of this Sjollema⁽³⁾ found that calcium chloride injected into the blood-circulation of a milk-fever patient gave a quick recovery. Moreover, Davidson⁽⁴⁾ claims that by feeding minerals the number of cases of milk-fever in a herd of from eight hundred to one thousand cows in Hong Kong was markedly decreased.

While discussing milk-fever it is interesting to note that cases of paralysis in ewes, both before and after lambing, have been recorded by Young and Dalling⁽⁵⁾, in Scotland and in the north of England, which responded readily to udder-inflation—that is the common treatment for milk-fever. In these records it is stated that such ewes almost invariably have twin lambs. Owing to the similarity of this condition with milk-fever in cows, and also with ante-partum and post-partum paralysis of ewes as recorded in New Zealand by Gilruth and Reid⁽⁶⁾, it is not unreasonable to hope that a calcium addition to the diet might be beneficial to pregnant ewes.

To continue this reasoning it is not improbable that post-partum paralysis in cows (that is, the condition in which cows go down after calving and, although bright and apparently in good health, are unable to rise for a period of from one week to ten days) may also be laid at the door of a calcium deficiency.

Very recent investigations by Montgomerie, Savage, and Dodds, and by Harvey⁽⁷⁾, into tetany in mares, a condition in which suckling mares suffer from nervousness, excitement, and twitching of muscles, show that the blood of the patients is deficient in calcium, and that udder-inflation brings about a rapid recovery.

A further nervous disease—namely, Australian stringhalt—has been associated by Corlette⁽⁸⁾ with a calcium deficiency. In that article the scientist remarks on the similarity of the symptoms produced in fowls by feeding a ration of low calcium content to those of the Australian enzootic stringhalt in horses, which disease has been described in New Zealand by Reakes⁽⁹⁾.

Among bone-diseases found in New Zealand, osteomalacia, osteoporosis, and rickets have been proved to be at least in part due to insufficient calcium in the diet.

Pica, or depraved appetite, is a digestive disturbance of cattle due to a deficiency of alkalines in the system, for the treatment of which a New Zealand authority, Reid⁽¹⁰⁾, has recommended bone-meal. Sand-colic is regarded by Corlette⁽¹¹⁾ to be due to horses eating sand and earth in an endeavour to restore the calcium content of their blood. Observant farmers may have noticed cows licking earth and "bone-chewing" for the same reason. With regard to young lambs, I have personal experience of their licking earth and of their devouring lime with avidity. In this respect it is possible that access to lime may have a beneficial effect on the disease of lambs known as "pulpy kidney," since at post-mortem a certain amount of earth is practically invariably to be found in the stomach. The possibility of a continued bacterial infection of lambs' intestines from this source cannot be ignored.

It has also been claimed by Lindsay and Archibald⁽¹²⁾ that cows fed on a calcium-deficient ration are difficult to get in calf; and by various American scientists⁽¹³⁾ that abortion is apt to occur among them, that they often produce weak calves, and that their milk yield suffers. Experiments at the Rowett Institute⁽¹⁴⁾ have shown that cows fed on a sufficient mineral diet enjoyed better health, bore heavier calves, and milked better than those on a mineral-deficient ration.

Apart from any question of disease, it has been shown that a heavy-milking cow gives out more calcium in her milk than she absorbs from her food, with the result that though on apparently excellent food she may become thinner and thinner as the period of milking proceeds, due to the fact that she is having to draw on her body supplies for her milk. With regard to growth, Ingle⁽¹⁵⁾, experimenting upon rabbits, proved that there is less growth, both in flesh and in bone, when an animal is fed on a calcium-deficient ration than when on a proper ration.

The question of how to administer the required calcium now arises. The practical methods available would seem to be (a) top-dressing with lime or superphosphate, (b) giving lime in the food, (c) giving bone-flour in the food, (d) giving lime in licks, and (e) pellet feeding.

With regard to top-dressing, an Australian writer, Rose⁽¹⁶⁾, advises the application of 1 cwt. of superphosphate per acre as a preventive of osteomalacia. Again, Godden⁽¹⁷⁾, a Scottish authority, has proved that top-dressing with lime increases the calcium content of grass. The giving of lime or bone-flour in the food, though having the disadvantage of requiring the animals to be fed chaff or oats, has the advantage of ensuring that each animal gets its requirements. Of these two the

latter is to be preferred, and is best supplied as steamed bone-flour. The putting-out of licks with a high lime content would seem to be the most practical method of supplying to sheep and young stock. The pellet-feeding method, at present under trial by Aston⁽¹⁸⁾, promises to be very useful, and has the decided advantage of supplying other mineral needs. Its application to big blocks of hill country, however, would entail a certain amount of extra labour.

In conclusion, it is not intended to claim for calcium as is claimed for many proprietary stock drenches—that it cures all ills, but merely to point out that all the above conditions have been associated with a calcium deficiency by various research workers. Many of the foregoing statements are still debatable, and since we do not yet understand the part played by disease of the parathyroid glands (the glands responsible for maintaining the level of the calcium content of the blood), the beneficial results of feeding calcium cannot be estimated. Nevertheless such evidence as we have is sufficient to warrant a greater use of bone-flour and lime in stock-feeding, and if the farmer fails to derive protection from disease for his stock he should at least find that his stock will be more robust and more productive.

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Control of Contagious Abortion in Cattle.—Mr. A. D. McEwen, of the Research Institute in Animal Pathology, London, who has just completed an extensive tour of the United States with special reference to contagious abortion, writes as follows. "There is no evidence to show that vaccine has any beneficial influence upon the disease once it is established. The disadvantages and limitations of vaccination have caused the great majority of research workers in America to abandon this method of combating the disease. The method which receives credit is the prevention of the spread of the disease by segregation of the infected animals."

Wheat Research Institute.—The laboratory of the Wheat Research Institute at Christchurch is now fully functioning and tests upon samples of grain collected during the past two seasons are in progress. The data for the field experiments at Lincoln College also are being analysed in conjunction with the laboratory tests. The expenditure of the Institute in the past year was largely connected with the fitting-up and equipment of the laboratory, and the Institute now possesses a first-class laboratory capable of dealing with all chemical, physical, and milling problems which concern the wheatgrower, flour-miller, and baker.

MOULDS IN UNSALTED BUTTER.

RESEARCH AT WALLACEVILLE LABORATORY.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Division, Wallaceville Laboratory.

ONE of the most important factors in the spoilage of unsalted butter for our export trade is that of moulds. In many ways the mould problem is harder to deal with than the bacteriological contamination of butters, the reason being that, although the latter trouble is difficult to overcome, numbers of bacteria that may enter the butter through the process of manufacture are harmless and their effects are not even felt in the ultimate flavour of the finished product. The possibility of contamination of unsalted butters by moulds at all stages of manufacture is as great as that by bacteria, but the difference lies in the fact that each mould-spore which enters is likely to have an immediate effect on the finished product.

The number of species of moulds that are of interest to makers of unsalted butter and are common in butter-factories in New Zealand is not great, and from the results of experiments carried out at the Wallaceville Laboratory it has been shown that only three of the six common moulds that have been found present in New Zealand unsalted butters are capable of germinating in two weeks from the time of defrosting; the other three species are only capable of germination after three weeks from the time of defrosting after two to three months at cold-storage temperature, by which time the butter would probably be consumed.

The six species mentioned are all capable of immediate germination in butters, and can all germinate at a temperature of 12° to 13° C. in one week, causing immediate and visible effects. These species are all common in the factory atmosphere—in fact, most butter and cheese factories are probably impregnated with moulds. Large patches of moulds may often be seen growing on the concrete walls and wooden roofs of butter-rooms. A favourite part of the factory for mould growths is the woodwork surrounding the chilled water-tanks, and the walls and ceilings in the neighbourhood. From these positions the contamination spreads to all parts of the factory and affects everything that comes into contact with the butter. Factory water-supplies are often seriously contaminated.

The main source of mould contamination of unsalted butters is undoubtedly through atmospheric contamination of the cream in the freezing-vats after pasteurization, where the cream remains exposed to the air overnight. A mould and bacteriological survey has recently been made of various factory atmospheres by exposing petri dishes containing sterile glucose agar (of a rather higher percentage of glucose than that usually employed in bacteriological work) by the side of the cream-vats for the duration of time that the cream remained in them. On incubation at the laboratory the plates showed a very considerable mould count from the spores or seeds of the moulds that had fallen on their surface, several plates showing a count of seventy-six to eighty individual colonies. It might here be mentioned that these plates showed a representative number of the six common moulds already



FIG. 1. CROSS-SECTION OF BLOCK OF UNSALTED BUTTER, SHOWING BLACK-SPOT MOULD (STEMPHYLIA)

Note depth of mycelial growth, and development in open spots and fissures.

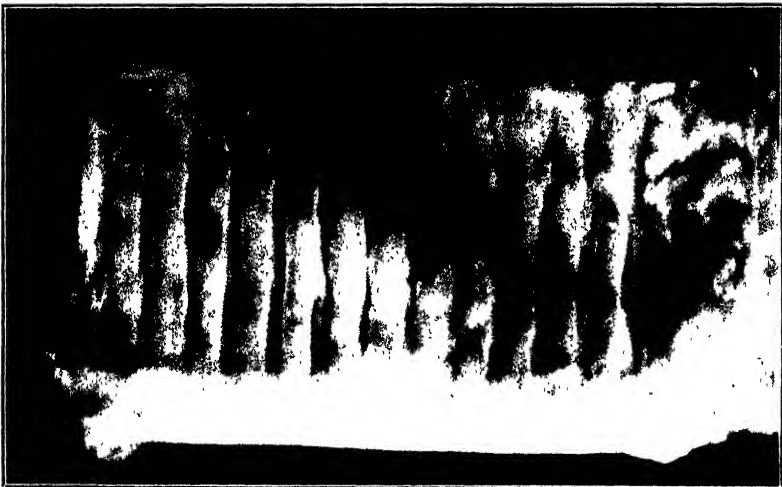


FIG. 2. OUTSIDE APPEARANCE OF BUTTER SHOWN IN FIG. 1.

[Photos by G. F. V. Morgan]

referred to, though the two moulds that were most common were *Cladosporium herbarum* and *Cladosporium butyri*. It is probable that if the media used had been capable of growing all the species of moulds whose spores were present in the factory air the mould count would have been very much higher. Moulds, however, do not grow equally

well on all media, and a glucose agar was chosen as one that grew the greatest number of different species. The disadvantage, however, of using glucose agar only lies in the fact that it will not grow well moulds of the *Stemphylium* type, which are among the most common present in the butter-factory, and give rise to the black spot in butter that is a very common fault.

Types of Moulds found present in Unsalted Butters.

The types of mould found present were as follows: *Penicillium glaucum*, *Stemphylium*, *Fusarium lactis*, *Oidium lactis*, *Cladosporium herbarum*, *Cladosporium butyri*.

Penicillium glaucum.—Among the above-mentioned moulds the most common is *Penicillium glaucum*, the spores of which are to be found practically everywhere. Apart from dairy-produce, this mould may be found growing on a variety of objects where the atmosphere is cool and humid. It is commonly found growing on stale bread, and on jam that has been allowed to remain open in a damp cupboard. *Penicillium glaucum* produces a blue-green growth consisting of clusters of aerial hyphæ and conidiophores, at the head of which are the conidia or seeds of the mould. The actual habitat of the *Penicillium* type of mould in the factory is hard to determine. In most factories comparatively little trace of the mould itself is found on the premises, but the exposure of petri dishes to factory atmosphere shows that the spores of this mould are present in considerable numbers. Butter-boxes and parchment that are allowed to get damp very soon develop growths of this mould; butter-salt occasionally contains its spores, and the power of the spores to germinate after remaining in dry salt for a considerable time seems to remain unhampered. Spores of the mould are also frequently found in the water used for washing the butter. Factory experience seems to point to the fact that the *Penicillium* type of mould is found to a greater extent in the drier part of a butter-factory, such as the butter-box store, than in the butter-room itself, where the atmosphere is more inclined to be warm and steamy.

Stemphylium.—As distinct from the *Penicillium* type, this mould is most frequently found in and about the butter-room and over the storage-tanks for chilled water. Patches may be seen growing on the concrete walls of the butter-room and round the receiving-stage, but the heaviest growth is usually found on the wooden ceilings of the butter-room. The probable reason for this is that the natural habitat for this mould is rotten wood, and it is, as a rule, not very long before the woodwork of the factory butter-room gets waterlogged by the steam that is continually rising from the pasteurizers and acquires a more or less decayed condition. When this happens moulds of the *Stemphylium* type make their appearance. From the woodwork of the ceilings the mould spreads to the concrete walls of the factory, which absorb moisture fairly readily and are nearly always in a damp condition. The appearance of this mould is quite characteristic in so far that it produces a much finer aerial growth than moulds of the *Penicillium* type, though the conidia themselves are shorter. The mould produces characteristic dark-brown or black patches somewhat resembling soot.

Fusarium lactis.—This mould is responsible for the red spot found in unsalted butters. Apart from the red discoloration caused by the mould, a similar pigmentation may also frequently be caused by a *Torula* producing a red colony on artificial media. This *Torula*, however, is a very slow worker at low temperatures and does not grow well in butter, though it may grow luxuriantly on damp butter-parchment or on damp butter-box wood, where it produces numbers of bright-red spots. It is also capable of developing a red pigment in cream and milk, but only after a considerable time has elapsed following inoculation. *Fusarium lactis* is the most delicate of all the common butter-moulds. It suffers most from long-continued cold-storage temperatures, though it will germinate in less than a week at a temperature not lower than 10° C. The red discoloration in unsalted butter is very marked when present, but is most frequently found in unsalted butters used for local consumption, and not in the butters after arrival in Europe. The spores of this mould are common in all factory atmospheres, and may frequently be found present in factory water-supplies.

Oidium lactis.—This is perhaps the most common mould associated with dairying. It is most frequently seen on the crusts of soft cheese, particularly Coulomier and Pont l'Evêque, but is a common development on all dairy-produce. This mould develops a tangled mass of aerial mycelium, giving a white felted appearance to the medium in which it may be growing. Apart from the white patches on the surface of butter, it does not seem to produce any discoloration in the body of the article itself (a slightly brown discoloration has sometimes been noticed in very old cultures of this mould in butter), but its presence gives the butter a distinct flavour similar to that imparted by certain types of yeasts and typical of the types of soft cheese already mentioned. The flavour can be recognized sometimes long before the white surface growth is visible. This mould is so common in dairying that dairy-produce may also be considered its natural habitat, but is not of very great importance in the manufacture of butter for export. It is, however, one of those moulds that will resist cold-storage temperature for three months and germinate in less than two weeks after defrosting. Spores of this mould are nearly always present in both salted and unsalted butters, but frequently die out without germinating. Periodical examination of unsalted butters have shown that the mould is present in a virile condition for about six weeks after manufacture, and that the spores are capable of germination for about this length of time when the butter is held at room temperature, though the mould rarely becomes visible on the outside of the butter and can only be demonstrated when cultures are made on artificial media suitable for its growth. After six weeks the mould gradually dies out. The spores of *Oidium lactis*, though they will not germinate in salt above 4 per cent., will germinate on transfer to a suitable medium containing less than that percentage.

Cladosporium herbarum.—This mould produces characteristic olive-brown patches in unsalted butter. As the butter containing the mould matures, the olive or dark-brown patches change to black. A characteristic feature of both *Cladosporium herbarum* and moulds of the *Stemphylium* type is that they do not appear to produce any considerable growth of aerial mycelium or conidiophores in butter, and

usually the only visible sign of their presence is the discoloration that they produce. In the case of *Oidium lactis* and *Fusarium lactis*, however, a thick felted mass of aerial mycelium is produced in unwrapped butter-samples containing these moulds. *Penicillium glaucum* also produces thick tufts of conidiophores terminating in typical bushy green heads. The spores of *Cladosporium herbarum* are common in all parts of a butter-factory, but are found most frequently on petri-dish exposures taken in the butter-room and damper parts of the building.

Cladosporium butyri.—This mould is in many ways similar to *Cladosporium herbarum*. The important point of difference is that *Cladosporium butyri* commences its development with a white growth which gradually changes to a dark olive in the centre and then to a very dark olive and black. Cultures of this mould in cream and butter show a dark-olive background in the early stages of development, and a thick growth of tangled white mycelium over the surface, giving the mould two distinct shades of colour simultaneously. This mould is not nearly so common as *Cladosporium herbarum*; nevertheless it frequently occurs in unsalted butter.

Cultural Methods and Technique in Examination of Unsalted Butters.

In the research work carried out at Wallaceville Laboratory the cultural characteristics of the various moulds were not considered to any great extent, as it was realized that cultural characteristics of moulds differ considerably according to temperature of incubation, and acidities, humidity, and composition of the media in which the mould spores may be cultured. Sources of contamination and the structure of various moulds were studied closely, as was also their power to resist low or high temperatures, and the action of brine solutions and formalin on their spores. For cultural purposes three types of media only were used throughout the experiments conducted. The work included the examination of more than two hundred samples of butter from various factories in the North and South Islands of New Zealand, many of the butters having been made for show purposes.

In the examination of these unsalted butters the samples were taken under sterile conditions, and allowed to remain at room-temperature for a sufficient length of time for the moulds to make their appearance on the surface of the butter. In the two hundred samples examined containing moulds by transfer to artificial media on which the growth was more luxuriant and easier to study, only the six moulds already listed were found, with the exception of one sample that was found to contain *Aspergillus fumigatus* instead of *Penicillium glaucum*, and another that contained *Fusarium elegans* instead of *Fusarium lactis*. The former of these two moulds is common in cheese but uncommon in butter. It is not clear why this should be the case, as *Oidium lactis* and *Penicillium glaucum* are common in both, and *Stemphylium* appears fairly frequently on the tops and bottoms of cheese as a black dust. The two artificial media that were found most useful for pure culture work were Czapek's media for *Aspergilli* and malt agar. In both cases the media used were of normal pH. The composition of the media is as follows :—

Czapek's agar (for Aspergilli).

Distilled water	..	1,000 c. c.
Sodium nitrate	..	3 grammes.
Potassium phos	..	1 gramme
Magnesium sulph.	..	0.5 gramme
Potassium chloride	..	0.5 gramme
Ferrous sulphate	..	0.01 gramme.
Sucrose	..	30 grammes.
Agar	..	50 grammes.

Malt Agar.

Distilled water	..	1,000 c. c.
Malt	..	50 grammes
Agar	..	30 grammes

The effects on unsalted butter of each of the individual moulds described were studied by using sterile cream, inoculating it with spores of the mould required to be grown, and churning the cream in the flask in which it was sterilized and inoculated. In these cases no effort was made to accomplish a thorough working of the butter, as the possibility of contamination appeared too great. In all cases where pure culture transfers were made of mould-spores from one medium to another, control or check plates of casein agar or nutritive glucose agar were also similarly treated, as neither of the media previously mentioned is suitable for bacterial development. Casein agar is particularly suitable for bacterial but not yeast development.

Cultural and Structural Characteristics and Differences in Development of Moulds in Unsalted Butter.

STEMPHYLIUM.

Contamination.—This mainly occurs through the growth of the mould on the woodwork and damp concrete walls of butter-factories; most commonly found on the woodwork round the cool water-tanks. Dark sooty patches typical of the development of this mould may be seen on almost any damp concrete in or around the butter-room. The mould is capable of growing through paint if it happens that it has already obtained a foothold before the wood or concrete was painted, and this applies particularly to paints which contain an excess of turpentine. Spores from the growths already described ultimately become detached, circulate in the factory atmosphere, and settle in the cream while it is in the freezing-vats.

Spore-formation—Spores are numerous, and grow at the termination of very short hyphal cells. Their growth is not confined to aerial development, but also takes place in the body of the medium in which it may be growing, particularly in loose-textured butter, producing a concentration of dark colour where this occurs. The spores are multicellular and of varying size and shape; most of them show a regular egg-shaped growth containing seven or eight cells, each of which is capable of individual germination, though when their germination is watched in a suitable liquid medium under the $\frac{1}{6}$ lens of the microscope only one cell per spore appears to germinate. Cells of these spores may be very irregular in shape, and may contain as many as ten cells visible under the microscope. The spores are usually dark brown to black in colour.

Mycelial Growth.—In artificial media and butter this mould produces a dense reticulated mass of short hyphal cells forming the mycelium,

which stains readily. Spores are produced in clusters at irregular intervals over the surface and in the body of the medium in which it may be growing. Pigmentation occurs in the cells of the mycelium, but it is not diffused to any extent into the body of the butter. Mycelial cells appear smooth and regular in shape, unlike the roughened cells of the *Aspergilli* and a number of other moulds. Mycelial growth as a rule only extends $\frac{1}{2}$ in. into the body of the butter—usually less, unless it follows a fissure in the texture. Growth of aerial hyphæ is usually very short though dense, and resembles patches of black dust rather than colonies of moulds. The spores of the mould are capable of germinating on the surface of butter-paper, and the mycelia of growing into and through the butter-paper into the body of the butter itself.

The thermal death-point of mould-spores is difficult to determine, more particularly in liquids which are of interest to the dairyman, as their resistance to surface tension causes most of the spores to float on the surface of the medium. A number of experiments on the thermal death-point of spores have been carried out at Wallaceville, but great irregularity has always attended the results. In the series of plate cultures, on the surface of Czapek's mould medium, *Stemphylium* spores have germinated irregularly after heating in water, milk, and cream from 50° to 70° C. Germination has never occurred at a temperature higher than 70° C.

Resistance of moulds to brine solution is fairly great. Moulds of the *Stemphylium* type are capable of germinating and growing well in media containing 6 to 7 per cent. of salt, and the spores of this mould will germinate after remaining in a saturated solution of salt for fifteen minutes.

Resistance to Formalin.—Spraying or painting with weak solutions of formalin is quite useless to prevent or check the growth of moulds. Mould-spores will germinate after remaining in 4 per cent. formalin for ten minutes. The use of disinfectants for reducing mould-development in factories has in most cases been found unsatisfactory. The most useful chemical for the destruction of moulds is mercuric chloride, and this, owing to its highly toxic properties, should on no account be used in or about a factory. Formalin or chloride of lime may be used in the factory, but are generally used in far too weak solutions, and if used in strong solutions their effect is fully felt for far too short a period for them to be really effective. It has been found that even when substances that have been treated with strong solutions of formalin are allowed to stand at a suitable temperature and humidity for a week the mould so treated has again appeared. Spores of *Stemphylium* are capable of remaining virile in water for more than four months, and may therefore form a lasting contamination of factory water-storage tanks.

Biochemical Action and Effect on Dairy-produce.—The effect of bacteria-free cultures of *Stemphylium* mould on dairy-produce has been watched during the course of work on butter-moulds at Wallaceville. Further and more complete work on the chemical changes produced is shortly to be undertaken. Cultures grown from spores apparently free from bacteria in so far that check cultures carried out on casein agar showed no bacterial growth showed that this mould was rapidly



FIG 3 PHOTOMICROGRAPH SHOWING MYCELIAL GROWTH AND HEAD FORMATION TYPICAL OF STEMPHYLIA MOULD (P_{12} LENS.)



FIG. 4 (LEFT). PHOTOMICROGRAPH OF SPORES OF STEMPHYLIA, HIGHLY MAGNIFIED.



FIG. 5 (RIGHT). PHOTOMICROGRAPH SHOWING GERMINATION OF MULTICELLULAR SPORES OF STEMPHYLIA.

[Photos by G. F. V. Morgan.

proteolytic, with the production of an alkaline condition in artificial media, cream, and milk, probably due to the production of ammonia in the breakdown of the protein. Marked gas-formation was noticed, but no fermentation of lactose, though there can be little doubt that sugars generally, as well as lactose, can be used by this mould in the development of its tissue. It is capable of growth in water in which a weak solution of lactose has been added, and, though the spores can remain virile in water for more than four months, they are incapable of germination and development of mycelial growths in water alone. There is little doubt that once the mould has been established in butter it has a very definite effect on the butterfat, but after a number of experiments moulds could not be induced to grow in butterfat from which casein, sugar, and moisture had been removed, nor would they grow in butterfat and lactose.

Anaerobic Growth. Experiments have recently been carried out at Wallaceville on the power of butter-moulds to germinate anaerobically. Plate and butter cultures were sown with the spores of the *Stemphylium* mould and placed in a McIntosh and Fildes anaerobic jar. The experiment was carefully carried out; control tubes of methylene blue, glucose, and caustic soda were used as indicators, and complete anaerobiosis was obtained. The results of several series of growths were considerably varied. A number of plates showed no growth at room-temperature in ten days; other plates showed a slight growth at one week. However, several strong growths were obtained. In all cases the indicator remained colourless after the flask had been closed and the electric current cut off. All the six butter-moulds listed will grow well under partial anaerobic conditions. Incubation was carried out at 20° C.

Behaviour under Cold-storage Conditions.—Several samples of sterile cream have been inoculated with spores of the *Stemphylium* mould, and subsequently churned by shaking in the flasks in which the cream was sterilized. The buttermilk was then removed with a sterile siphon and the unworked butter divided into two portions, one of which was incubated at a temperature of from 10° to 12° C.; the other, after transfer to a sterile flask, was placed in cold storage varying in temperature from 3° to 5° C. The butter cultures incubated at 10° C. germinated in one week; those placed in cold storage showed no sign of growth in three months. On removal from cold storage, and after defrosting, the *Stemphylium* mould grew well after two weeks at room-temperature.

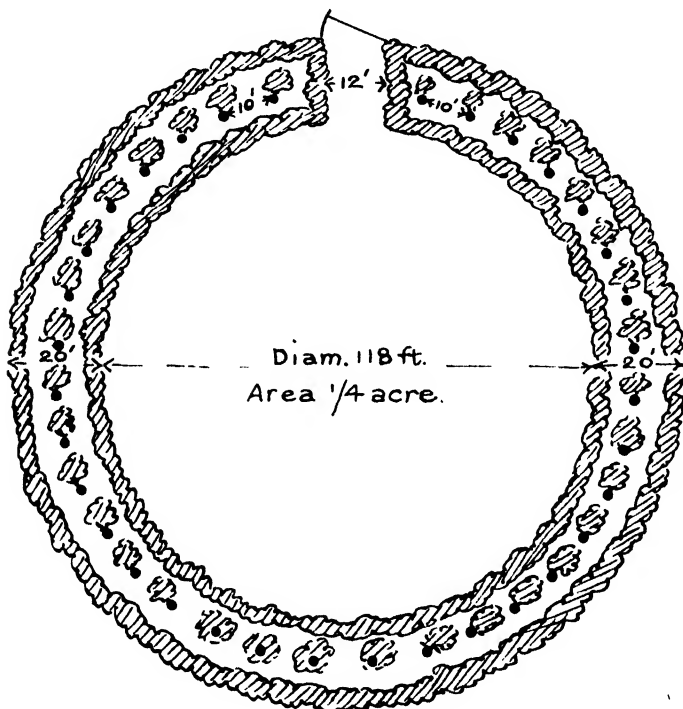
(To be continued.)

Cleaning of Dairy Pipe-lines—In a recent report Mr. W. Dempster, Dairy Instructor, Hamilton, mentions that at the Waitoa and Waharoa skim-milk-powder factories the cream is conveyed to the butter-factories, some chains distant, by pipe-lines which were erected some years ago and are still in good order and have never given any trouble. The pipe-line is cleaned by first pumping through it warm water (about 130° F.), followed by a soda solution (about 100°). There is a steam connection into the pipe (so that the steam travels back towards the pump and the pump is also steamed) where a spring valve releases the steam when the pressure reaches 7 lb., and, after the soda washing, the steam is blown through for half an hour.

A SHELTER-RING FOR STOCK.

(Extract from State Forest Circular No. 25, 'Farm Shelter'.)

WHERE close shelter is required for a limited number of animals, such as a herd of cows or a mob of newly shorn sheep, the idea presented in the accompanying diagram should prove to be of practical use.



(As an alternative a square formation may be used.)

A dry hillock should be selected, or, if such is not available, the highest part of the paddock. First set out a circle enclosing sufficient space to accommodate the stock to be sheltered, then erect two fences round the circle 20 ft. apart, with gateway facing north. Before closing the fences, plough and cultivate the area to be planted. Mid-way between the fences, plant a row of conifers (species according to soil and climate), and against each fence a hedge of barberry, eleagnus, or boxthorn, &c. (also according to soil and climatic conditions). Once established, this shelter-ring should require only an occasional examination during the planting season to replace any failures.

CITRUS FRUITGROWING IN NEW ZEALAND.

Lecturette by P. EVERETT, Orchard Instructor, Thames and Bay of Plenty district, broadcast from Radio Station 2YA, Wellington, July, 1929.

It should first be explained that the name "citrus" is a generic name for a number of plants, and includes lemons, oranges, limes, citrons, grapefruits, mandarins, and shaddocks. All these fruits are to be found growing in New Zealand to a greater or lesser extent.

Most of the citrus family are natives of India and other warm parts of Asia; consequently the colder parts of this country are not generally suitable for their growth. The best localities for their culture are in the east coast region of the Auckland Province. In the year 1928 the area in orange and lemon trees in Auckland was 875 acres, as compared with 160 acres for all other parts of New Zealand combined. During the four-year period from 1924 to 1928 the area in these fruits increased by 139 acres in the Auckland Province, whereas the increase for all other districts was only 12 acres.

Regarding the quantity of these fruits produced in New Zealand, it is estimated that during the year ended 31st March last the production for the Tauranga district alone was approximately 15,000 bushel cases of lemons and 1,500 bushel cases of oranges. When it is borne in mind that there are comparatively few citrus-orchards in New Zealand yet in full bearing, and that probably more than one-half of the orchards have not yet commenced to bear fruit, it will be seen that this young industry already counts for something. Further, the increased area being planted annually goes to show that considerable progress is being made in the culture of these fruits.

Persons contemplating the planting of citrus fruit-trees for commercial purposes would be well advised to go very thoroughly into the matter of suitable varieties and stocks, for varieties that have proved suitable for commercial planting in some parts may not give satisfaction in other parts. Information on these matters can always be obtained from the district Orchard Instructor, or from the Director of the Horticulture Division, Department of Agriculture, Wellington.

For those wishing to grow a few trees for domestic purposes I would suggest the following varieties as being suitable:—

Lemons: Lisbon, Genoa, and Eureka. For the colder parts of New Zealand the Meyer lemon is claimed to be most suitable, but it is not generally recommended for commercial planting at the present time.

Oranges: Ruby, Washington Navel, and Navalencia. For marmalade the Poorman orange is the best. There are probably more Poorman orange-trees grown in New Zealand than all other varieties together, and their fruit is rapidly coming into favour for dessert use.

Other citrus fruits, such as grapefruits, limes, mandarins, citrons, and shaddocks, will all thrive well in warm and sheltered locations in the North Island, and bear good crops of fruit. Citrus-trees, being

evergreen, are often grown on lawns for ornamental purposes. For fruit-production, however, it is most important that they be planted in well-drained soil and in a sheltered location.

Brief reference will now be made to the diseases and insect pests that are troublesome in citrus-orchards. Citrus-trees do not require nearly the same amount of attention as do most other fruit-trees. For instance, apple-trees are often sprayed as many as nine times a year, whereas citrus-trees seldom require more than three sprayings annually, and in many orchards one spraying is all that is necessary. The three most serious troubles citrus-growers in New Zealand have to contend with in their orchards are citrus brown-rot, red scale, and verrucosis. In many orchards that have been well cared for from the time of planting neither red scale nor verrucosis has yet made its appearance.

Brown-rot has been present in parts of Auckland Province for many years, but was not general throughout citrus orchards in this district until the winter of 1927. During that winter extensive damage was done in a great many orchards, not through the disease being difficult to control but because growers were caught unprepared. In most parts of New Zealand all that is necessary to keep citrus-trees free from brown-rot is to spray before the disease makes its appearance each winter with bordeaux mixture, at a strength of 4-4-40. In certain clay soils it has been found necessary to supplement this treatment by applying sulphate of iron to the soil under the trees, and by cutting away all limbs growing near the ground.

Verrucosis, which causes grey-coloured scabs and protuberances on lemons, can be kept in control by applying one bordeaux spray annually during the month of November. Where trees are severely infected, three sprayings should be applied each year until the disease is got under control.

Red scale is more difficult to control than either of the other two diseases mentioned. To combat this insect spraying-oil should be applied. Reasonable control can be effected by spraying once annually, the most effective time being either the last week in February or the first week in March, according to the seasonal conditions. To make certain that every portion of the tree is coated with the spray it is necessary to first see that the tree is reasonably open. In cases of severe infestation two sprayings annually are advisable, the first early in February and the second towards the end of March. This treatment suggested for the control of red scale is equally effective for other scale insects and citrus red-mite that are at times troublesome on citrus-trees.

Now for a few remarks to consumers of citrus fruits, which includes almost everybody. For many years past there has been a certain amount of prejudice against lemons and oranges grown in our own country, brought about by the false impression that the locally grown fruit was invariably inferior to the imported article, and that the keeping-quality was also inferior. This prejudice happily is now disappearing as a result of the more up-to-date methods of handling the fruit now being practised by our growers.

It is held that for all ordinary uses the first-grade locally grown lemons are equal in quality to the best imported lemons. Regarding oranges grown in New Zealand, in many cases this fruit is not equal to the imported article that has been grown in a warmer climate. However, varieties suitable to our climate, and grown under favourable conditions, will produce fruit that leaves little to be desired.

The main reason why the prejudice referred to has existed may be said to be that until very recent years most of our lemon-growers marketed their fruit individually, practised crude methods in handling their crop, and adopted no measures for the prevention of decay. For instance, lemons were very often forcibly pulled off the trees, and this frequently damaged the base of the fruit. In other cases the fruit was allowed to drop on to hard ground and become bruised. It was then gathered and roughly tipped into cases, and straightway despatched to market. Again, the trees were stripped of all coloured fruit about every third month, which resulted in many lemons being oversize and having a thick rind. Lemons handled in a rough manner can seldom be kept long before decay sets in, and when the fruits are lying packed in cases the rot rapidly spreads from one to another, so that in a few weeks a large proportion in the case will have been destroyed.

The present-day methods of treatment of lemons in New Zealand show much improvement compared with those prevailing a few years ago. Picking of the fruit is now done monthly so that over-sized fruits will be avoided, for, no matter how green in appearance a lemon may be, if it has attained the most desirable size it is ready for picking. The minimum size for picking is usually $2\frac{3}{8}$ in. diameter. Experienced pickers can tell at a glance the size of the fruit; pickers of less experience usually carry a ring with a diameter of $2\frac{3}{8}$ in. for measuring fruits of doubtful size. The fruit is severed from the tree by small secateurs designed for that purpose, and carefully placed in picking-bags. From the picking-bags the fruit is removed, one by one, into the orchard case, and then conveyed to the curing and packing depot. On arrival at the depot the fruit is graded. The yellow lemons are also separated from the green lemons. All of the better-grade fruit is placed in single-layer trays and stored in a curing-room specially constructed for the purpose, light being eliminated as much as possible and a moderate even temperature maintained.

These trays of lemons are looked over periodically, and any fruits showing signs of decay are removed. When the fruit has become thoroughly cured it is removed to the packing-room, where it is washed. When dried it is graded to size, for fruit with a difference of more than $\frac{1}{4}$ in. in diameter should not be packed in any one case. Every first-grade fruit is wrapped in tissue-paper, and packing is done systematically in new cases. The cases are wired at each end, so as to prevent breakage if roughly handled during transit to market.

Lemons treated in this way can be relied upon to keep at least three months after being put on the market without excessive wilting, and with a smaller percentage of decay than is general with much of the imported fruit. The chief advantages of a

properly cured lemon over an uncured one are that in the process of curing the thickness of the rind is reduced by about 50 per cent. without giving the fruit a wilted appearance and without reducing the juice content.

As regards New-Zealand-grown oranges, their former unpopularity has been principally due to the fact that until recently a large proportion of the fruit offered for sale was from seedling trees which produced a poor type of fruit. However, there is now a considerable area in Auckland Province planted with the best varieties. Many of these trees are now coming into bearing, and each year more of their good-quality fruit is being sold on the local markets.

In New Zealand there are two co-operative curing and packing depots for the handling and marketing of citrus fruits, one being at Tauranga and the other in Auckland. The depot at Tauranga is handling approximately 90 per cent. of the lemons grown in the Bay of Plenty, while the Auckland establishment handles a considerable quantity of citrus fruits grown in the vicinity of Auckland City and at Whangarei. These co-operative organizations have done valuable work in standardizing grades and in preventing the marketing of uncured and poor-quality lemons. Lower-grade but suitable fruit from these depots is sold to factories for use in connection with the manufacture of lemon juice and peel.

DAIRY FACTORIES IN NEW ZEALAND, 1929.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1929, and the numbers of milk or cream suppliers to the factories—

District	Number of Factories				Forwarded for Export 1928-29		Number of Suppliers to Factories.	
	Butter.	Cheese	Dual Plant.	Total	Butter.	Cheese	Butter.	Cheese and Dual Plant
					Tons.	Tons.		
Auckland ..	60	30	6	109	52,130	12,753	17,700	1,320
Taranaki ..	23	75	33	171	7,780	35,996	2,780	3,567
Wellington ..	18	49	10	91	9,187	13,416	4,955	1,657
Hawke's Bay ..	12	16	2	35	4,008	4,160	4,030	592
Nelson ..	6	3	1	11	1,258	478	1,190	447
Marlborough ..	3	1	4	10	725	807	760	206
Westland ..	9	2	1	12	629	37	657	41
Canterbury ..	9	14	3	30	1,565	1,926	4,568	1,889
Otago and Southland	11	79	1	97	1,616	13,044	6,453	3,225
Totals ..	151	270	66	566	78,904	82,017	43,153	12,944

When butter was manufactured as a side-line at seventy-nine of the above cheese-factories in 1928-29, the total quantity forwarded for export being 1,324 tons. This is not included in the total amount of 78,904 tons of butter given in the table, which refers to creamery butter only.

In the 1928-29 period there were also operating in the Dominion six milk-powder factories (three whole-milk and three skim-milk plants), five casein-factories, two condensed-milk factories, and one sugar-of-milk factory.

SEASONAL NOTES.

THE FARM.

BETTER UTILIZATION OF PASTURE-GRASS IN DAIRY-FARMING.

AUGUST marks the start of a new dairying season, and dairy-farmers should now carefully consider the improvement of their pasture-management methods, so as to make the greatest possible use of the feed that will be produced by their grasslands during the season. At the present time the better utilization of the feed already produced by our pastures is probably more important than increasing grass-production by the more liberal use of fertilizers. In the long-settled dairying districts, where annual top-dressings of 3 cwt. to 4 cwt. per acre of phosphatic fertilizers are usual, the average farmer has reached a stage where it is extremely important that he adopt better methods of grass-utilization before embarking on a more extensive manurial programme. It is important to remember that although improved methods of pasture-management must accompany the more intensive use of fertilizers, it is not necessary, at any rate for a start, that the intensive use of fertilizers should accompany improved methods of utilization. Farmers should endeavour to use all the grass their pastures are already producing before endeavouring to greatly increase their grass-production. Extension of the practices of hay- and ensilage-making to conserve as much as possible of the surplus early summer production of grass for periods of grass shortage, and the adoption of improved methods of grazing, are of prime importance in improving our present methods of grass-utilization.

An increase in the area saved for ensilage should be the first forward step undertaken, and the storing-up of a large reserve of ensilage should always precede the adoption of more intensive methods of grass-farming and an increase in the numbers of the dairy herd. Besides providing a reserve of fodder for supplementary feeding during periods of poor grass-growth, the mowing of rank pastures during November greatly improves the subsequent pasture-growth. Pastures cut for silage in November produce much more feed in the autumn than pastures cut later for hay.

Grass ensilage made in pits or trenches requires much less manual labour than where the material is stacked in the field. Indeed, it is really much easier to convert the material into silage, where the pit method and horse-sweeps are used, than to make it into hay. The storage of some of the surplus production of grass as ensilage should therefore become just as much a matter of routine on dairy-farms as the making of hay.

An improvement in grazing methods will increase the carrying-capacity of grassland without unduly raising the cost of production of farm-products. The close subdivision and rotational grazing of the best grassland of the farm will greatly raise its carrying-capacity, and leave a large surplus of grass on the rest of the farm

for conversion into hay and ensilage. Close subdivision and rotational grazing are also important factors in improving the turf on pastures. Pastures which are allowed to get rank, or on which the grazing is uneven, or which are subject to close and continuous grazing, tend to deteriorate, while rotational grazing helps to build up a rye-grass and white clover pasture. Dairy-farmers cannot hope to obtain a long, high-producing lactation period from their cows unless perennial rye-grass forms an important element of the pasture sward, for rye-grass throws good feed in the early spring when most other grasses are practically dormant.

ARABLE CROPPING WORK.

The sowing of spring cereals and the ploughing of land for spring- and summer-sown root and forage crops will keep the teams or tractor busy in the coming month on all days the land is fit for working. Normally the spring operations can be lightened by making every endeavour to get the stubbles intended for root and forage crops turned over in the early winter; and grassland intended for turnips and rape should be ploughed if possible before the sowing of spring cereals. Early ploughing, besides increasing the amount of moisture held in the land for the use of crops, exposes the soil to the weathering agencies of the atmosphere, and the breaking-down of the soil under the influence of the weather will lessen the amount of cultivation work necessary in the spring to obtain a fine seed-bed.

In dairying districts of the North Island there is normally no imperative need for the early winter ploughing of grassland for root and forage crops, owing to the high rainfall experienced. The land should be broken up by the middle of August, so as to allow sufficient time for the grass-sod to rot before the crop is sown.

PRODUCTION OF EARLY SPRING FEED.

August and September are usually difficult months on dairy-farms. If the weather is cold there is usually little grass-growth until the end of September. Top-dressing in the autumn and shutting up pastures in June allows a good deal of the winter growth of grass to be saved for the spring, but this growth is usually finished by the middle of August, and production often falls during late August and early September. The ability of winter dressings of nitrogen to produce good early spring feed will again be watched with interest during the coming months, and if the use of these nitrogenous fertilizers is shown to be a payable proposition one of the greatest difficulties in the satisfactory feeding of dairy cows in the early part of the season will have been surmounted.

—*P. W. Smallfield, M.Agr.Sc., Fields Superintendent, Auckland.*

CARE OF DAIRY COWS DURING THE WINTER MONTHS.

Most of the dairy herds are now dried off and the cows are having a much-needed rest from production. There are several methods of drying-off cows; the main object should be in all cases to leave the udder in such a condition that the tendency to inflammation in the organ is reduced to a minimum. The usual method is to gradually

increase the time between each milking. In the case of the more high-producing animals considerable difficulty is experienced at times in drying-off. It would appear that nothing short of starvation in these comparatively few cases is sufficient to prevent milk-secretion, and in such instances it is better to continue milking throughout than to deprive the animal of a sufficient food-supply.

The pregnant cow, whether producing or not, has to meet the demands of a developing foetus, besides maintaining her condition, or, as is more to be desired, the replacing of a deficit resulting from the past season's production, and also a reserve for the ensuing season's production. Good ensilage as a foodstuff is superior in feeding-value to roots alone, and about equal to roots combined with a liberal allowance of good hay. Inferior ensilage, on the other hand, has a low food-value, due to the effect of harmful acids of fermentation.

In connection with winter feeding, especially where roots or chou-moellier form the major portion of the ration, there is a danger of the trouble known as "red-water" occurring. This trouble is apparently due to too much bulky watery feed, and can be prevented by combining hay with the root ration. Moreover, the cow is more benefited and maintains better condition when roots are not used to excess, and when fed in conjunction with a quantity of well-saved hay. Lucerne hay or clover hay is more valuable on account of its containing a higher percentage of calcium and protein, very necessary elements in the development of the unborn calf. Frosted roots are dangerous, as they may cause severe indigestion and bloating.

Occasionally trouble is experienced when feeding ensilage to cattle, and here again the excessive use of ensilage alone is in many cases the cause of the trouble. An attempt should be made to combine hay with a watery food such as ensilage, roots, and chou-moellier. In far too many cases no attempt is made to balance the cow's winter ration on account of a shortage of concentrates, but, where available, a small dairy ration of a concentrate rich in protein, such as some of the recognized cattle-cakes, should be used. From experiments it has been shown that the extra return in milk-yield from cows receiving a concentrate ration has more than paid for the increased cost of feeding. There is also the satisfaction that an attempt is being made to balance a ration which is otherwise much too bulky, with an excess of water and starches. It is a noteworthy fact, also, that in town-supply herds, where concentrate feeding in winter is necessary to maintain the milk-supply, many troubles to which dairy cows are prone are not so prevalent. In connection with the feeding of mangels to cows, occasionally it is forgotten that these roots require to be stored for some weeks before feeding. If the foregoing points are borne in mind a considerable reduction in the winter mortality of dairy cows from digestive troubles should be effected.

Almost every winter cases are reported of cows dying from paralysis before or after calving. On investigation it is quite apparent in some cases that the animals have not received sufficient food during the winter. If cows are worth keeping it always pays to feed them well; a scarcity of winter feed is merely a question

of mismanagement of the balance between summer and winter requirements. It is always safe to provide a quantity of hay in excess of apparent requirements. Any excess may be held over, or may be fed with advantage during the spring months.

A saving of winter feeding may be effected by the provision of shelter and warmth. In the digestion and absorption of food a certain amount is required to repair waste, to maintain condition, to provide for the developing calf, and to maintain the heat of the body. If, then, the heat of the body is maintained by the provision of shelter from hedges, or by the use of covers for the cattle, less food is required for heat-production, with a consequent improvement of condition in such animals. In many cases also the method adopted of feeding out hay in the paddocks is a wasteful method, a portion being lost through being trodden into the ground and destroyed by rain. The feeding of hay out of movable racks has an advantage over the usual broadcast method.

In conclusion, the building-up of condition and reserves in the animal helps to ward off attacks of disease. The animal's resisting-powers are reinforced by good feed, and as a consequence one may expect less trouble from paralysis and other ills which occur about calving-time.

--Live-stock Division.

THE ORCHARD.

SPRAYING.

EARLY next month will mark the beginning of a new season's activities in the control of pests and diseases. As this is one of the main factors in fruit-production, and success depends on months of well-directed effort, a brushing-up of one's knowledge of control methods now will prove helpful. The spraying diary recommended by the writer some time ago, if such has been kept, might be studied also with the idea of putting into practice lessons it may have taught. Spraying-materials should be ordered, and the spraying outfit put in readiness. The overhaul of the spray outfit should be given a place of preference on the list of wet-day jobs during the winter. Then the fruit-grading machine will require a good cleaning and the making of adjustments. Picking-boxes could be repaired and renailed, and all implements cleaned and oiled.

A good working knowledge of the materials used in spraying may be gained from studying the Department's bulletin on "Control of Orchard and Garden Pests and Diseases." The various materials recommended, and their uses, may be briefly summarized as follows:—

(1) Poisons for chewing and biting insects: Arsenate of lead is almost universally used for control of such chewing-insects as codlin-moth, leaf-roller caterpillar, and pear or cherry slug. Fruit and foliage must be kept thoroughly covered with the spray, and applied in anticipation of attack.

(2) Contact sprays for sucking-insects: Red oil has proved most effectual for such pests as mussel, San Jose, and other scales, aphides,

pear-mite, thrips, &c., and is used towards the end of the dormant period or as the buds show some movement. Contact sprays are applied when the pest is actually present. Other contact sprays used for certain purposes are lime-sulphur and Black Leaf 40. Lime-sulphur is very useful in the control of red mite and San Jose scale, mostly as a summer insecticide; it is, however, used chiefly as a fungicide, and as such serves both purposes. Black Leaf 40 used as an insecticide in the growing-period, acting as a fumigant, controls such pests as leaf-hopper and aphides.

(3) Fungicides for the control of fungus diseases: Lime-sulphur, bordeaux, and finely precipitated sulphur have their specific uses, and are employed in the control of such diseases as black-spot on apple and pear, leaf-curl on peaches and nectarines, bladder or pocket plum, powdery mildew on apples, shot-hole fungus on apricots, and brown-rot on stone-fruits.

Stone-fruit requires attention first, and the necessity for using an insecticide should be determined on the condition of the trees. Red mite and San Jose scale, if present, would require treatment with oil, making an application at 1-17 immediately before bud-movement. It is necessary at this particular time of the year to select a good sunny day for applying oil, so as to ensure better penetration into cracks and rough surfaces. Where there is a heavy infestation of scale the only satisfactory means of dealing with it is to remove the heavily-infected branches and spray thoroughly the remaining portions. Badly infected branches located during picking operations should be marked at the time.

Bordeaux is used a little later, at a strength of 8-6-40, for the control of leaf-curl, shot-hole, bladder-plum, and peach-rust. This application should be made when the buds begin to swell. Delaying this spray till the blossom-buds are expanded may allow spores of leaf-curl and shot-hole to become active and infection to take place. On varieties liable to severe attack a second bordeaux spray, at strength 3-4-40, may be applied when colour is showing in the buds. The practice of applying an oil spray following bordeaux is not recommended, as the application of oil so delayed necessitates such a reduction in strength as to render it of little use, otherwise buds are damaged. Bordeaux may be applied following closely after oil if a spreader is used.

COMPLETION OF PRUNING.

Pruning should now be well in hand, and every effort made to complete it before there is any movement in the buds. Any interference with the tree during the growing-period causes a check, and on weak trees is particularly undesirable. Trees which still appear too heavily spurred and which made but poor growth should receive especial attention in the way of extra spur-pruning, so as to reduce the amount of blossom and encourage growth. Heavy spur-pruning, leaving the stronger and younger spurs, will frequently cause quite a burst of growth from fruit-spurs, and often gives better results than a drastic cutting-back of a tree that requires renovating.

All prunings should be gathered and burned as a sanitary measure in the control of disease. By using a pruning-sheet of

hessian or other material the gathering of prunings is made easier and complete. A pruning-sheet requires to be a square, the side of which is equal to the distance between trees, with an opening from the middle of one side to the centre and bound on the edges. Two men working together can readily shift the sheet from tree to tree.

PLOUGHING AND MANURING.

Where the ground is in suitable dry condition cover-crops should be ploughed in. Trees should be dug round before the spring to bury all leaves and rubbish. Most lands require occasional limings, and lime may be applied at any convenient time during the winter. Probably an average of 1 ton per acre every three years will suffice. It is better to spread the lime prior to ploughing. Fruit-trees require annual applications of fertilizers if heavy and regular crops are to be expected. The general application of fertilizers may be deferred till nearer the spring. However, if slower-acting organic manures such as blood-and-bone are to be used, applications may be made now with advantage.

REWORKING OF TREES.

Many varieties which at one time were regarded as quite profitable to grow, having their particular virtues, are now, through changed conditions, regarded as inferior and unprofitable in the main. Such trees may be worked over to more suitable varieties by grafting. The operation is performed in the spring. Scions should be selected now, taking medium-sized last year's growth and preserving them in good fresh condition by heeling-in in a place which is cool, shaded, and sufficiently moist but not wet. Trees which through overcropping, neglect, and other causes have become debilitated may be rejuvenated by working over in the same manner.

Trees intended for working over could now be cut down to within a few inches of the height at which it is intended to graft. This saves much time in the spring if much grafting is to be done. The final cut is then made at the time of the grafting operation. The choice of variety is a matter which cannot be covered by a general recommendation. Local conditions, existing varieties in the orchard, and suchlike considerations must guide one largely, and it would be better to consult the nearest Orchard Instructor in regard to such an important matter.

—N. J. Adamson, *Orchard Instructor, Hastings.*

Citrus-culture.

Land may now be prepared for new plantations, careful consideration being given to providing adequate shelter and thorough conditioning of the ground. Good drainage is the first essential. If the land is not of such a porous nature as to permit the excess water to percolate away readily under-drainage must be provided. Tile drains of suitable dimensions according to the length of drain are preferable, but if for financial reasons these cannot be provided, drains of logs and brushwood will give good service for some years. A thorough working of the upper subsoil is also advisable, but it

should be done uniformly over the whole area with a subsoil-plough, not merely by digging under where the tree is to stand. This latter method is bad practice, as it encourages the water to stagnate locally to the detriment of the tree. General surface levelling should also be done while the area can be regulated without interference from trees. Throughout the whole preparation it should be remembered that working the land when it is not in a fit state will have a compacting effect difficult to correct later. It is better to delay operations until the soil works freely.

Varieties of lemons recommended for planting are as follows :—
Lisbon : The well-known variety of constant and early cropping habit practically all the year round, but heaviest in late winter.
Eureka : Quite as desirable and fruitful as Lisbon ; the tree is practically thornless, and the main crop carried in summer. Meyer : A recently introduced variety of special merit for domestic planting ; more frost-resisting than Eureka or Lisbon

Among preserving-oranges, the Poorman yields a heavy and constant crop wherever citrus fruits can be grown. Medium to large fruits, the largest of which may be used for breakfast purposes. Season of harvest May to September.

In sweet oranges the following are recommended :—Navelencia : A good orange of late season. Valencia Late : A navel orange of late season. Lou Jin Jancy and Pineapple : Varieties of recent introduction with great promise ; they should be tried in a limited way.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

HATCHING OPERATIONS.

BREEDERS are reminded that August and September may generally be regarded as the best months of the year in which to hatch out the main crop of chickens for the production of eggs during the winter season when high prices rule.

Thus every endeavour should be made to secure the required number of young stock before the end of September. It should be remembered that the right season extends over a very short period. Chicks brought out on the early side--say, early in July--are apt to go into a moult just when high-priced eggs are expected. On the other hand, if the hatching is delayed until the approach of summer the chickens will fail to produce until the following spring, when low prices for eggs prevail. Not only this, but such stock seldom grow to a desired size, and consequently lay small-sized eggs, besides always being more susceptible to every passing ailment than are the earlier-hatched birds. The margin of profit to be made from late-hatched stock is low, even in normal times, but the present high cost of foodstuffs facing the poultry-keeper, and the existing general tendency towards cheaper eggs, may easily mean a loss instead of a gain.

In the case of those who have to depend on the natural mother for hatching purposes the difficulty of securing chickens during

August and September is realized, as at this period of the year broody hens are scarce, and as a result hatching operations are delayed beyond the most desirable season. Rather than delay on this account, however, the better plan is to resort to artificial methods, either by purchasing an incubator or by securing day-old chicks. The latter method as a means of overcoming the difficulty of securing broody hens when most required is an ideal one for the man in a small way, providing the chicks are procured from a reliable breeder of heavy-laying stock. With a fireless brooder made from a petrol-case, as illustrated in the Department's bulletin "Utility-poultry Keeping," these day-old chicks can be satisfactorily reared when the necessary attention is available. In this way chickens can be secured at a season when they will have every opportunity of developing well and of coming to a laying-point at the most profitable stage.

ARTIFICIAL INCUBATION.

Hatching chickens by means of incubators is an important work in connection with the poultry plant, but it is one of the most difficult matters on which to guide the novice by means of printed advice. There are so many different styles of machines, and such considerable variation in the methods of providing the necessary temperature, ventilation, and moisture, that it is impossible to lay down any general instructions which will suit all machines alike. The best advice to the novice is that before starting he should carefully study the instructions sent out by the maker regarding the working of the particular incubator he proposes to use. The novice would also be well advised to select an incubator from among those makes that have proved their value to our successful poultrymen, rather than be led into buying a cheap inferior article on a trade advertisement only. It is only safe to depart from the maker's instruction when the operator has had considerable experience in incubation work, or when he is following the advice of a man of wide knowledge in artificial hatching.

No two incubators on the market require exactly similar treatment, but there are certain rules which can be applied to all machines. For example, if eggs are to hatch out at the right time the correct range of temperature must be maintained throughout, the thermometer must be located accurately, so that the recorded temperature is being experienced in the right place—that is, in a line with the top of the eggs. The germ of an egg floats uppermost, irrespective of the position in which the egg is resting. Thus the necessity for having the bulb of the thermometer resting on the top of a fertile egg will be seen. Stale eggs will always take longer to hatch than those that are fresh, and allowance must be made for this. Eggs intended for incubation should be placed in the incubator as soon after being laid as possible. Eggs will often retain their hatching-qualities when a month old or even older, but usually the chicks produced from these are delicate and difficult to rear.

Reverting to the matter of temperature, this should be maintained at about 102° F. for the first week, 103° for the second and

third weeks, and 104° when hatching. If after having followed this range of temperature the eggs do not pip up to time, the only safe course to take with the following hatch is to work a degree higher, as it goes to indicate that the thermometer is not registering the correct degree of temperature. It is important that every care should be taken to prevent an excessive degree of temperature in the incubator, or trouble may be expected during the brooder stage, through the yolk of the egg failing to become absorbed. The yolk is drawn into the body of the chick just before it leaves the shell, and under proper incubation conditions the yolk in its sac will be found in a more or less liquid state, enabling it to run freely, and finally to become absorbed. On the other hand, where the temperature has been allowed to go too high during the whole or part of the incubating period the yolk becomes half-baked, rendering it incapable of absorption. Once a chick becomes affected in this way little or nothing can be done for it, as usually it will succumb at some time during the brooder stage. Prevention is the one thing to aim for, and the first essential in this connection is the maintenance of an even temperature during the incubation period.

ARTIFICIAL BROODING.

Probably the greatest cause of mortality in artificial brooding is allowing chicks to huddle, this being usually induced by not providing the little birds with a uniform degree of warmth. Huddling means sweating, and its effect is manifested in several ways, the chief of which is a chill when the chickens leave the brooder. This brings on a weakened state, which is usually manifested by bowel trouble and a general lowering of vitality. Another effect of chill is a weakness of the legs and a wobbling walk, indicating that the chickens are huddling at night and require more warmth. The young birds, feeling the need of more heat, huddle in the corners of the brooder, each one trying to secure an inside position, which is the warmest. The trouble is often intensified by a lack of sufficient bedding on the floor, especially when the floor is very smooth, when the constant slipping on the smooth surface during the huddling effort has the effect of spreading and weakening the delicate legs. On the first sign of this condition being observed additional warmth should be applied, by means of extra flame in a heated brooder and extra covering in the case of a fireless brooder. The aim should be to make the chicks comfortable, as only in this condition can they be expected to thrive. If the chicks are spread over the floor of the brooder it may be taken for granted that the degree of warmth being maintained conforms to that demanded by instinct, whereas if they are huddling it is a sure sign that more heat is required. When chicks have acquired the habit of huddling in corners, as a result of chill, it is often difficult to break them of it. In artificial rearing it is always a waste of time to try and rear weaklings, as they seldom or never develop into profitable stock. Not only this, but usually they are the first to acquire the habit of huddling, and teach the stronger birds to do likewise, with consequent heavy mortality.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

PREPARATIONS FOR THE NEW SEASON.

DURING the dormant season every spare moment should be spent in making preparations for the next season's work. All defective supers, roofs, and bottom-boards should be overhauled, and where necessary given a good coat of paint. This work, if delayed, is apt to interfere with the main work in the apiary when the bees are calling for special attention, and should not be postponed.

If it is desired to increase the apiary, hive and frame making should be pushed on, and ample provision made for increase before the actual time arrives for putting preconceived plans into operation. Where the beekeeper does not make his own hives he should now order sufficient stocks to see him through the season. In the majority of cases it does not pay him to make his own appliances. Hive-manufacturing in the Dominion has been brought to a high standard, and unless the apiarist has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale, he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on those lines. Non-fitting supers and frames mean extra labour, and lead to endless trouble. The sizes in use are mostly ten- and twelve-frame, and experience of his district will enable the beekeeper to decide as to the best one to adopt.

To meet those cases where cost is a consideration, a durable frame hive which will comply with the provisions of the Apiaries Act can be made out of a petrol-case. Petrol-cases are obtainable for a few pence, and can be readily converted by any one handy with tools. A kerosene-case may also be used, but it will be found necessary to reinforce it, so that the petrol-case is the handier. Particulars of a cheap home-made hive are given in the Department's Bulletin No. 128, "Beekeeping."

Overhauling the hives: As advised last month, all supers should be removed and the bees confined to the brood-chamber. This will keep the bees snug and promote brood-rearing, and at the same time facilitate the work of giving the hives their first spring over-haul. During the course of the winter there is usually an accumulation of pollen, dead bees, &c., on the bottom-boards, and consequently the latter require cleansing. All operations at this period should be carried out quickly as a safeguard against robbing. To cleanse the bottom-board a spare one should be brought into use. Set the hive temporarily on the spare board while scraping and cleansing the permanent one, then replace the hive on its permanent stand. See that the hives have a slight cant towards the entrance. This will prevent moisture settling on the bottom-board, which is apt to cause the death of a considerable number of bees, besides making the hive damp and unwholesome.

SPRING WORK.

During August, whenever the temperature will allow, the colonies may be given their first examination. It is highly important that this work should not be postponed until brood-rearing has started in earnest, more especially in cases where ample stores were not left to carry the bees over early stages of this important function. Delay in making an examination may lead to spring losses, and nothing is more annoying than to find colonies dead through neglect to provide sufficient stores. Usually a colony's requirements are attended to in the late autumn, when the apiarist endeavours to gauge the amount of food requisite to carry the bees through the winter and spring periods. It may happen, however, that mild weather is experienced, when the drain on the stores to feed the young bees, if not supplemented, will reduce a colony to starvation. Nothing should be left to chance during the critical months of spring, and no effort spared to see that each individual colony has sufficient food to meet current demands. Colonies which contain 15 lb. to 20 lb. of honey may be left until a later examination. If the hives contain less they should be watched closely and preparation made for feeding. See Bulletin No. 128, page 27, regarding the spring feeding of bees.

QUEEN-RIGHT COLONIES.

The most important factor in a colony's condition is its queen. Advantage should be taken of the first examination to see that the queen is all right. If a colony is in normal condition as regards strength and stores there should be fair-sized patches of brood in the centre frames, but this is not sufficient to determine that the colony is queen-right. The cells adjacent to the brood should be quickly examined for eggs, which are the only indication that the queen is present. If neither brood nor eggs are found, then shelve the question of the colony being queenless till about ten days later. At each examination make a note of each hive and its condition for future reference.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

THE plant-beds should now be prepared ready to receive the young seedlings, which will be ready for pricking out towards the end of August or early September. A warm, sheltered, well-drained position should be chosen for this work. It is customary to sterilize the soil where the plant-beds are to be made, by burning a quantity of brushwood on the site. A few rather large pieces of wood may be placed across the plot to create a suitable draught, and on them brushwood, straw, &c., piled to a height of 3 ft. to 4 ft., and weighed down with a few pieces of heavy timber. This should be lit when the weather conditions will permit of a steady burn, and the heat will thus destroy most of the weed-seeds, insects, and fungus pests liable to attack the crop. When the

land has cooled, remove the larger fragments remaining, and broadcast a mixture of 3 lb. superphosphate and 4 lb. carbonate of lime on an area 12 ft. by 4 ft.—the size of the average nursery bed. This should be mixed well with the soil to a depth of 4 in. to 5 in., and reduced to a fine friable tilth.

To protect the plants a 9 in. board should be placed round the beds to hold the scrim or cheesecloth shade cover used after planting. To prevent this cover from sagging, cross-battens are fixed across the beds at intervals. If there is any danger of flood-water scouring the site, a trench should be dug on the high side and given a suitable outlet to carry the water away; or if the drainage is not all that could be desired the bed should be raised 5 in. to 6 in. above the normal level.

To enable the work of planting out to be done neatly and quickly a planting-board is necessary. It is best made of heart matai wood, the length being 3 ft. 9 in., thickness $\frac{1}{4}$ in., and width 4 in., while on one edge a double 2 in. bevel should be made.

Where nursery plants are not obtainable these plant-beds may be sown down with seed. Before doing so see that the soil is moist and in suitable condition. A teaspoonful of seed is sufficient for 100 square feet of bed, and to enable an even distribution to be made it is customary to mix it well with about twenty times its own bulk of sifted wood-ashes or dry sand. Sow evenly, first crosswise and then lengthwise, and afterwards tread the seed in or pat it down with a spade. The boxing should then be placed in position, and the cloth cover securely fixed. Sometimes a closely woven fabric has been used for this purpose, and the seedlings have damped off for want of ventilation; this is a mistake that should be avoided.

Next in importance to good seed-beds and plants is a well-prepared field in which to set them out. This is where many new growers have failed. Where grassland is to be used it should be skim-ploughed, and, when the turf is well rotted, deeply cross-ploughed as before stated. This deep ploughing, which should be done in early winter, may be followed by a light ploughing towards the end of this month, and the land well broken down with disk harrows.

TOMATOES AND SMALL-FRUITS.

Tomato-plants for the cool glasshouse should now be well advanced. Water them sparingly with tepid water as necessary, and give them air during the warmer hours of the brighter days. Close the house up tight early in the afternoon to retain the heat. The land in houses where the crop is to be raised should now receive what manures are required, and the final cultivation be given before planting out towards the end of August. The soil should be firm and well settled before planting is done, and houses in which the soil has been allowed to dry out should be thoroughly saturated with water some time previous to planting. Tread the plants in firmly after planting, and keep the house closed for a few days until they are well established. A temperature of 55° to 65° F. should be maintained, and remember that any check given to the plants at this period will be at the expense of the early fruit. Plant in shallow drills, and use tepid water when necessary.

Plants left over are sometimes hardened off for planting outside in October and November, but this is a mistake, as they remain too long in the boxes and thus receive a check in growth from which they are slow to recover. Seeds for the outside crop should be sown now, and a foot or two of fermenting stable manure in a cold frame is a very suitable place in which to raise them in most districts. Such plants make a continuous growth without a check, and do better in every way.

In the small-fruit section, apart from the spraying of strawberries, attention should now be given to shallow hoeing in fine weather for the purpose of breaking up the surface crust and destroying seedling weeds. Deep cultivation at this season of the year, with injury to the fibrous roots which lie near the surface, is a common cause of serious losses in these crops.

THE MARKET-GARDEN.

Plantings of autumn-sown onions, lettuce, cabbage, and cauliflowers made last month, also sowings of lettuce, radish, spinach, onions, and broad beans, should be given first consideration in fine bright weather, and lightly hoed to destroy seedling weeds before they gain any size. In addition to the foregoing, plant now artichokes, shallots, asparagus, and early potatoes. Also sow shorthorn carrots, turnip-rooted beet, parsnips, main-crop onions, parsley, and early turnips.

In many cases sowings of cabbage and cauliflower for early summer cutting should be considered by those who have suitable land; also asparagus for planting out twelve months hence. Work the surface soil down to a fine tilth before sowing, and sow thinly and so save seed and much of the labour of thinning. To protect seed-peas from vermin sprinkle them with kerosene and red-lead; stir them well to distribute the dressing, and spread them out to dry before sowing.

Complete the preparation of land for the sowing of main crops in September, and half-hardy crops in October. Seeds of a good variety and strain and suitable land well prepared are the main secrets of successful cropping.

HOME GARDEN AND SPORTS-GROUNDS.

The planting season for hard-wooded plants ends with the month of August in most districts, and work of this kind should be completed as soon as weather permits. New lawns may be sown down during the coming month. On old greens burn out weeds and stimulate the grass with dressings of sulphate of ammonia. If this is done later in the season the patches will hardly recover sufficiently well before summer playing begins. Where the playing is hard an area of turf should be specially grown for patching at any time. Ample reserves of turf should be held for this purpose, giving the green every attention in order that the requisite condition may be maintained.

—W. C. Hyde, *Horticulturist*, Wellington.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JANUARY TO JUNE, 1929.

Dairy Division.

THIRTY-SEVEN cows received certificates-of-record during the six months ended 30th June, 1929, this being the slack period for the C.O.R. system. It will be noticed that a number of good performances are recorded in the appended list, which is a creditable one generally from the point of view of production.

* Cow milked three times daily during whole lactation period. † Milke 1 three times daily during part of period

Name of Cow and Class	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Elcho Bonny ..	C. J. Masters, Hunterville	2	91 249.6	365	10,909.8	582.38
Takapu May ..	R. C. Jury, Tikorangi	2	54 245.9	365	8,860.3	484.19
Majesty's Bonny Duchess	G. Hodgson, Whakapara	1	236 240.5	365	6,860.0	423.95
Roslyn Confetti ..	H. Smith, Patumahoe	2	30 243.5	351	5,277.9	334.24
Springhill Buttercup	H. Smith, Patumahoe	1	270 240.5	358	5,367.4	333.93
Bethune Rosina ..	A S W. Hazard, Waimate North	2	7 241.2	257	7,258.2	324.47
Crofton Polly ..	F. H. Noffke, Halcombe	1	328 240.5	275	5,062.8	318.93
Highsteads Quality ..	F. E. Day, Tamahere	1	265 240.5	305	5,030.0	272.07
Senior Two-year-old						
Okauia Leaflet ..	R. K. Garland, Matamata	2	287 269.2	364	8,393.6	432.84
Orange Dale Elva ..	W. Hall and Son, Matatoki	2	343 274.8	268	6,117.1	306.73
Three-year-old						
Ferndale Viola's Duchess	J. J. Springgay, Gisborne	3	131 290.1	365	8,889.5	471.09
Pinedale Flirt ..	H. Lewis, Waiaroa	3	67 283.7	360	8,556.2	404.69
Gay Lady ..	F. E. Day, Tamahere	3	321 309.1	328	5,583.7	343.32
Four-year-old.						
Rewa Friday ..	A. Christie and Co., Hiku-rangi	4	37 317.2	365	10,431.8	583.85
Conqueror's Jess ..	Kilgour Sisters, Kiwitea	4	9 314.4	281	9,604.0	561.85
War Bride of Puketapu	T. H. Western, Bell Block	4	191 332.6	351	9,019.0	538.22
Ku Ku Sunbeam ..	J. Leslie, Ohakune	4	36 317.1	307	9,085.8	460.73
Green Park Tiny ..	J. T. Warman, Katikati	4	149 328.4	347	7,929.7	400.58
Mature.						
Noble Fernleaf ..	G. Hodgson, Whakapara	7	4 350.0	365	12,413.7	612.93
Rewarder's Golden Berbery	F. C. Butt, Opotiki	5	357 350.0	365	11,223.0	602.90
Elf's La Primevere ..	J. Robb, Wanganui	6	158 350.0	365	8,154.1	480.88

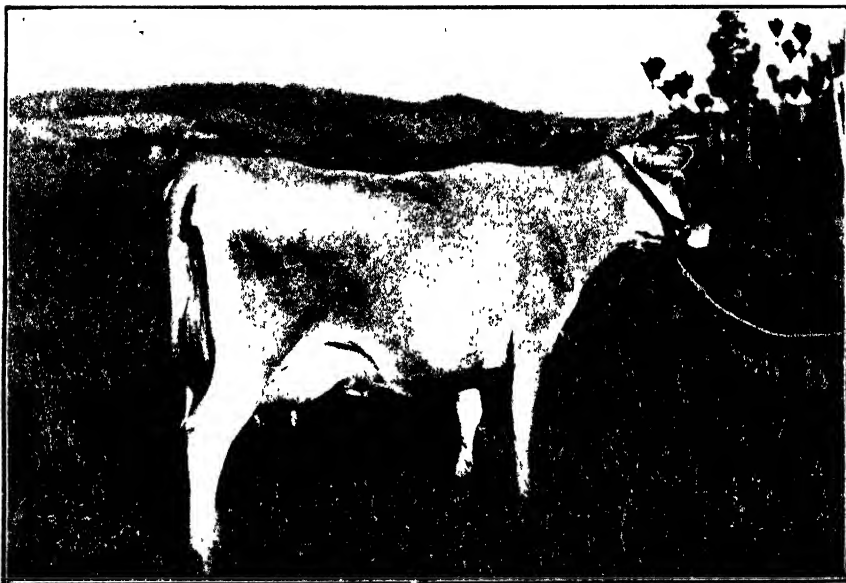
FRIESIANS.

<i>Junior Two-year-old.</i>						
Pareora Ethel Echo*	A. S. Elworthy, Timaru	2	99 250.4	365	17,344.0	583.29
<i>Senior Two-year-old.</i>						
Hillside Leila*	Mickell Bros., Te Horo	2	189 259.4	365	17,003.0	761.60
Hillside Burkeyje Blanco*	Mickell Bros., Te Horo	2	341 274.6	365	12,858.5	560.01



HILLSIDE LEILA (MICKELL BROS., TE HORO).

C.O.R. in senior two-year-old Friesian class : 17,003 lb. milk, 761.6 lb. butterfat.



FLANDRINE'S VIXEN (R. E. CLEMENTS, DARGAVILLE).

C.O.R. in Jersey mature class : 12,598.8 lb. milk, 722.42 lb. butterfat.

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS— <i>continued</i>						
<i>Junior Three-year-old.</i> Totara K.P. Dorothea*	Piri Land Co., Auckland ..	3	108	287·8	343 17,731·3	619·29
<i>Senior Three-year-old.</i> Pareora Model Cadillac*	A. S. Elworthy, Timaru ..	3	302	307·2	305 16,804·2	604·21
<i>Junior Four-year-old.</i> Rosevale May Echo Beets*	H. North and Sons, Omumu	4	33	316·8	305 17,803·9	654·53
<i>Senior Four-year-old.</i> Totara K.P. Colantha*	Piri Land Co., Auckland ..	4	199	333·4	321 16,932·5	617·15
<i>Mature</i> Faumata Tillyveld†	Oakview Stud Farm, Auckland	5	265	350·0	347 22,236·5	721·65
Rosevale Burkeyye Sylvia*	H. North and Sons, Omumu	10	108	350·0	304 19,424·0	602·85
Pareora Cherry Blossom*	A. S. Elworthy, Timaru ..	7	202	350·0	305 17,192·6	596·38

MILKING SHORTHORNS.

<i>Junior Four-year-old.</i> Riverdale Dolly 5th†	T. W. Wardlaw, Waimana	4	125	326·0	305 14,533·1	568·66
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*Second-class Certificates.***Jerseys.**

<i>Junior Two-year-old.</i> Linsell's Dovelet ..	J. Gaddes, Morrinsville ..	1	352	240·5	282 6,486·1	371·40
<i>Senior Two-year-old.</i> Elcho Fay ..	C. J. Masters, Hunterville	2	189	250·4	305 10,271·4	618·19
<i>Four-year-old.</i> Okawa Bangle ..	R. K. Garland, Matamata	4	28	316·3	365 6,185·6	402·87
<i>Mature.</i> Jersey Farm Pet ..	H. R. Benbow, Ormondville	5	41	350·0	305 10,063·7	560·78
Miss Doreen ..	R. Haylock, Ngaere ..	5	63	350·0	204 10,203·0	555·71

Howard Estate Advisory Board—The following have been appointed members of this Board under the Howard Estate Amendment Act, 1927, for the triennial period ending May, 1932: E. Averill, W. Cuthbertson, A. Robottom, J. H. Absalom, J. Livingston. Mr. Averill is named as chairman

Bone-char.—Bone-char, which appears among the importations of fertilizers into New Zealand, is a substance used as a clarifying and decolorizing medium in the production of cane-sugar. The spent material is used as a source of phosphate in the preparation of mixed manures.

WEATHER RECORDS : JUNE, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

JUNE began with good weather in continuance of the fine and dry conditions which had been the rule during May. General rains were recorded between the 7th and 12th, with many heavy falls in districts with a westerly aspect, but the weather was otherwise mainly fine and unusually mild until the 19th. From the 19th to the end of the month squally, boisterous weather, with heavy rains, was general. Unusually heavy snowfalls were experienced in Otago and Southland on the 28th and 29th.

Rainfall was much above the normal in the greater part of both Islands, although a few stations in Taranaki, Hawke's Bay, and North Auckland had less than the average. The May deficiency was thus made up, and any fears of a winter shortage were dispelled.

Temperatures were generally above the average for June, and there were few severe frosts, especially in districts north of Canterbury. The comparatively mild conditions, combined with the heavy rains, maintained a good growth of pasture. Many plants usually dormant at this time of the year are sending forth shoots or producing flowers. At Wellington, for instance, blossoms have appeared on numbers of pohutukawas. The bad weather of the latter end of the month affected the condition of hoggets to some extent, but otherwise stock are reported as doing well.

Many places recorded rather less than the average amount of sunshine.

Although the pressure systems again included a number of cyclones, the month was notable for a return to the westerly type of weather. This was particularly pronounced from the 22nd to the end of the month. A cyclone in the north Tasman Sea in the early days of the month passed without affecting New Zealand to any extent, and anti-cyclonic conditions and fine weather ruled until the 4th. A second cyclone of only slight intensity crossed Otago on the 7th, and was followed by a more vigorous one, the centre of which moved rapidly across Westland and Canterbury, on the 11th. Thereafter until the 18th fine weather, associated with a well-developed high-pressure system, was experienced over most of the country. During the 19th and 20th a cyclone which had developed suddenly in the south-west Tasman passed through Cook Strait, where the pressure fell almost to 29.0 in. This storm was accompanied by very heavy rains and severe gales, especially over the North Island.

The westerly weather already referred to then began to control the situation. From the 24th onwards the pressure difference between northern and southern places became large. In other words, pressure gradients became steep. Thenceforward until the end of the month strong winds blew almost continuously from between west and south. In western districts, especially in the North Island, gale force was experienced for much of the time. The period was remarkable for the number of tornadoes occurring. The most severe was one which struck the outskirts of Palmerston North at 3.25 p.m. on the 24th. A number of houses were damaged, trees were uprooted, and telegraph-poles levelled. Onaero, north of Waitara, experienced a less violent tornado on the 26th, and the Rotorua district another on the 27th. These whirls were accompanied by severe thunder and hail. Many other places also recorded thunder and hail storms. A number of stock were killed, and several human beings received shocks, two persons being rendered unconscious.

—Edward Kidson, *Director of Meteorological Services, Wellington, 6/7/29.*

RAINFALL FOR JUNE, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitiaki	8.21	16	1.99	5.53
2	Russell	4.30	16	1.30	7.14
3	Whangarei	5.88	21	2.15	6.22
4	Auckland	5.65	25	0.85	4.91
5	Hamilton	6.66	22	0.88	5.19
5A	Rotorua	8.54	18	1.86	5.24
6	Kawhia	7.54	20	0.82	5.72
7	New Plymouth	10.42	23	1.86	6.14
8	Riversdale, Inglewood	15.01	21	2.56	10.31
9	Whangamomona	15.85	19	2.72	7.62
10	Eltham	9.15	23	1.57	5.46
11	Tairua	4.68	16	1.18	7.38
12	Tauranga	5.29	17	1.04	5.42
13	Marachako Station, Opotiki	6.32	15	1.94	5.99
14	Gisborne	1.15	8	0.52	5.28
15	Taupo	7.23	16	1.55	4.48
16	Napier	0.88	13	0.21	3.59
17	Marakakaho Station, Hastings	2.94	14	0.74	3.33
18	Taihape	7.39	22	0.90	3.85
19	Masterton	5.08	17	1.28	3.48
20	Patea	6.14	16	1.45	4.15
21	Wanganui	8.01	14	1.80	3.19
22	Foxton	8.40	..	..	2.96
23	Wellington (Karori Reservoir)	6.03	14	2.81	4.63
<i>South Island.</i>					
24	Westport	10.17	24	1.43	7.53
25	Greymouth	9.77	20	1.20	8.27
26	Hokitika	13.83	20	2.20	9.60
27	Ross	19.87	17	5.84	9.20
28	Arthur's Pass	25.50	12	6.00	10.12
29	Okuru, Westland	20.45	15	5.36	10.76
30	Collingwood	14.20	20	2.27	11.33
31	Nelson	5.10	13	2.42	3.69
32	Spring Creek, Blenheim	6.40	12	4.50	3.01
33	Tophouse	12.19	17	2.10	4.75
34	Hanmer Springs	11.19	12	3.78	3.11
35	Highfield, Waiau	3.51	8	1.90	2.49
36	Gore Bay	4.58	12	1.90	2.34
37	Christchurch	3.08	14	1.70	2.66
38	Timaru	5.28	14	2.18	1.70
39	Lambrook Station, Fairlie	4.24	12	1.36	1.91
40	Benmore Station, Clearburn	4.08	18	0.82	1.90
41	Oamaru	4.46	16	1.30	2.01
42	Queenstown	2.82	10	0.59	2.46
43	Clyde	1.68	10	0.38	0.98
44	Dunedin	6.94	18	1.89	3.15
45	Wendon	5.02	12	0.96	2.42
46	Gore	4.88	18	1.00	2.82
47	Invercargill	4.40	22	0.85	3.60
48	Puysegur Point	8.69	23	1.35	6.58
49	Half-moon Bay	5.48	18	0.65	4.51

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DIET OF YOUNG DOGS.

R. J. DIAMANTI, Canvastown :—

Please inform me if raw meat included in their diet has any detrimental effects upon young pups (six weeks old), and whether it has a tendency to make them liable to contract distemper more easily.

The Live-stock Division :—

The diet of a young dog has no direct bearing on distemper, and raw meat as part of the ration does not render dogs more susceptible to that trouble. The basis of a diet for pups six weeks of age should be porridge and whole milk, if available. The protein of milk is more easily digested than that of meat, and young dogs must be gradually brought on to a meat diet. A little meat and a small bone occasionally can also be given, the meat ration being increased as the dog becomes older. In connection with raw meat for dogs it is essential that such meat should be free from hydatid cysts. Livers and other offal should be carefully examined for the presence of cysts. If cysts are present, either reject the offal or do not use it until after thorough cooking. Dogs are infested with tapeworms through eating raw offal affected with hydatid cysts.

FLOWER-CULTURE FOR MAKING OF PERFUMES.

“ PERFUMES,” Dunedin :—

Would it be possible to grow flowers—say, roses, lavender, rosemary, &c.—for making macerated oils and pomade so much used in the making of perfumes, and which must be imported into New Zealand in considerable quantities. We will be shifting to North Auckland during the next few months, and I should think the climate there would be just as suitable as the south of France and Bulgaria for the purpose mentioned.

The Horticulture Division :—

The growing of flowers and plants in this country with a view to distilling them for the perfumes they contain has been considered from time to time from the point of view of a commercial proposition, but although the soil and climate are sufficiently dry and warm in some parts of the country, the labour and marketing conditions here place us at a disadvantage in competition with European countries engaged in this trade in essential oils. It is doubtless possible to do something in this way here, but the commercial possibilities are not sufficiently attractive to recommend the undertaking. However, should you desire to test the matter it will be essential for you to obtain varieties of plants specially suited for the purpose, and then grow them in a well-drained soil where a warm dry summer season, which is necessary for the maximum production of essential oils, can be relied upon. In a wet climate the yield will generally be very low. The North Auckland country has rather a generous rainfall for the purpose, and the driest district there should be selected for the purpose of any experiment decided upon.

BLOOD IN COW'S MILK.

“ SUBSCRIBER,” Woodend :—

One of my cows has been giving a quantity of blood in her milk for some weeks. She is a second calver and has been in milk six months. It started in one hind quarter, then it got into a front one. The other two are all right. The udder is in no way hard or painful, and appears quite normal. Would you kindly inform me the cause, also treatment of the condition.

The Live-stock Division :—

This condition is most frequently brought about by small blood-vessels in the udder becoming ruptured owing to an intense congestion of the udder with blood after parturition. The act of milking reopens the injury, and until this heals a varying amount of blood will come away, particularly with the strappings. In this case time alone will remedy the matter, though it would no doubt be of benefit if you went about the milking as carefully as possible and did not strip right out. Another cause of the trouble is a bruise or contusion of the quarter, due to some external injury. The same line of treatment will apply, and in either case a drench may be given composed of $\frac{1}{2}$ lb Epsom salts, $\frac{1}{2}$ lb common salt, and 1 oz. ginger, to 1 quart of warm water. If the case does not improve send a sample of the milk to the Officer in Charge, Veterinary Laboratory, Wallaceville. If you do this, the bottle containing the milk, and also the cork, must be thoroughly cleaned and then boiled for several minutes to ensure that they are sterile.

KIKUYU-GRASS.

A. B. BABBAGE, Hauturu :—

Can you tell me anything about kikuyu-grass? One of the settlers here is trying it, and it seems to be doing well, and is much relished by the stock.

The Fields Division :—

Kikuyu-grass, introduced from South Africa, has been grown for the past six or seven years at the Puwera Experimental Farm, near Whangarei, North Auckland, and large numbers of parcels of roots have been forwarded to farmers in various parts of the Auckland Province for trial. The grass is established by planting out roots. When planting on a large scale, the work is lightened by first chaffing the roots, broadcasting the small sections over the cultivated land, and then disking them in. Planting out is best done in the spring. During the first two or three years after establishment the grass throws a large amount of very palatable feed, but as the surface soil becomes filled with the roots the stand becomes sod-bound and production decreases. The grass throws little or no feed in the winter and spring, and is cut back by hard winter frosts. Generally speaking, land areas suited for kikuyu would be better sown in paspalum. However, kikuyu is well worth planting on broken slips, sandy knolls, and other similar places which are difficult to grass.

" COW-GRASS " AND RED CLOVER.

J. T. BRIGHT, Waipukurau :—

Could you inform me whether there is any difference between cow-grass and red clover?

The Fields Division :—

There is no real difference between cow-grass and red clover. In New Zealand the large-seeded better-looking lines are usually sold as cow-grass, and the smaller-seeded lines as red clover. The term "cow-grass" is used to some extent in Britain, the name "double-cut cow-grass" being applied to the Broad Red and "single-cut cow-grass" to the Late Red clover types. There is, however, no legitimate reason for the use of the name "cow-grass," and the effort, both here and in Britain, is to get the term "red clover" used generally, and to eliminate the term "cow-grass" altogether.

LAYING DOWN COCKSFOOT FOR SEED PURPOSES.

D. S. STUDHOLME, Hinds :—

I wish to lay down a paddock of cocksfoot for seed purposes only. Land is free alluvial loam, without clay subsoil, and is infested with fat-hen seed. Should the cocksfoot be sown in spring or autumn? Should it be sown alone,

or are equally good results obtained by sowing with wheat, turnips, rape, or oats? If sown with a fodder crop, will the tramping of the sheep affect the young cocksfoot-plants?

The Fields Division :—

The cocksfoot-seed should be sown on well-prepared land, at the rate of from 20 lb. to 25 lb. per acre. We do not favour the idea of sowing with a cover-crop. Spring sowing is preferable, but in cases where fat-hen is very troublesome sowing is at times deferred till autumn. The autumn sowing frequently strikes dry weather, with the result that the plants cannot establish. In our experience we have found it beneficial to sow white clover, at the rate of 2 lb. or 3 lb. per acre with cocksfoot. Where this is done a better and quicker growth is obtained. Superphosphate should be applied at time of sowing, at the rate of 1 cwt. per acre.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 16th May to 11th July, 1929, include the following of agricultural interest :—

No. 62254: Fireless brooder, E. O. Peterson, Upper Hutt. No 59441: Wool bale or bag cramp; R H. Whisker, Wanganui. No. 59668: Milking-machine; W. R. Cockburn, Auckland. No 61686: Milking-machine; Aktiebolaget Separator, Stockholm, Sweden. No. 60635: Manure-distributor; M. Higgins, Mercer. No. 60711: Drying-apparatus for flax fibre; Maddren Bros., Christchurch. No. 60939: Flexible stock-brand; C. G. Teschemaker, Blenheim. No 61244. Indicator attachment for milking-machine; J. Treloar, Hamilton. No 62351: Draining tool; W. B. S Lindsay, Morrinsville. No. 59603: Manufacture of monocalcic and dicalcic phosphates from tricalcic phosphates; J. A Pond, Auckland. No. 61020: Producing fibre from flax, G. E. Field, Palmerston North. No 62298: Treatment of cheese; Kraft Walker Cheese Co. Pty., Ltd, South Melbourne, Vic. No. 62314: Cream- and milk-cooling device, F. Prentice, Foxton. No. 61544. Holding animals while being operated upon; J. A. Woodley, Aokautero. No. 61047. Egg-crate; Turner and Growers, Ltd., Auckland. No 61777: Flax-stripper, H. T. Greedy, Wellington. No. 62566: Milking-machine; T. H. Hartstone, Te Awamutu. No. 62770. Power apparatus for dairy-farms; General Electric Co, Ltd., London, Eng.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

INTERIM RETURN OF SHEEP AT 30th APRIL, 1929.

Sheep District.	Number of Sheep.		Increase.	Increase per Cent.	Per-centage of Total Increase
	Final Return, 1928.	Interim Return, 1929			
Auckland	2,380,475	2,704,188	323,713	13.59	17.2
Gisborne - Hawke's Bay ..	6,539,179	6,797,342	258,163	3.94	13.8
Wellington - West Coast ..	5,562,451	6,067,679	505,228	9.08	26.9
North Island totals ..	14,482,105	15,569,209	1,087,104	7.50	57.9
Marlborough-Nelson-Westland	1,361,043	1,451,962	90,919	6.68	4.8
Canterbury-Kaikoura ..	5,539,597	5,835,602	296,005	5.34	15.8
Otago	5,751,065	6,154,674	403,609	7.01	21.5
South Island totals ..	12,651,705	13,442,238	790,533	6.24	42.1
Dominion totals ..	27,133,810	29,011,447	1,877,637	6.91	100.0

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No. 2.

THE MACKENZIE COUNTRY GRASSLANDS.

PROGRESS OF NATURAL REGENERATION AND EXPERIMENTAL SOWINGS.

R. MCGILLIVRAY, F.L.S., Fields Superintendent, Department of Agriculture, Christchurch.

THE condition of the natural grasslands of the South Island is now becoming well recognized as a matter of national importance, and the Mackenzie Country, in the montane part of South Canterbury, has received considerable attention in this respect. When one examines the present state of large parts of the flats and lower hills of this region and visualizes their condition in the early run-holding days of seventy years ago, the retrospective view brings into prominence the very serious deterioration that has here taken place within comparatively recent times.

The Mackenzie Country was early occupied, and considerable burning of the runs took place from about 1860 onward until the early "seventies," by which time much of the work of nature, extending over untold years, had been damaged and in many cases destroyed. During the late "sixties" rabbits appeared and further aggravated the position, but they did not become a very serious pest until about 1877. Their onslaught on the native pastures then commenced in earnest, and depletion of the warm sunny faces and flats was soon in progress, especially where fire had already laid bare tracts of the country. The process of denudation was at first not very rapid, but followed step by step according to the treatment meted out to the vegetative covering by man and the introduced grazing-animals.

In considering the position one has to remember that in these inland regions the climate is one of extremes. The frosts of winter give place in September to drying winds, with a normally high day temperature until the late autumn. With conditions such as these it is not difficult to understand that under certain circumstances depletion was inevitable, and what has taken place in bygone years is not to be altogether wondered at. Indiscriminate burning of the vegetation, overstocking, and the rabbit pest have all contributed their quota towards the nakedness of much of the country to-day. Conditions such as described, together with the natural aridity of the inland plains, plus scorching



FIG. 1. SHOWING REGENERATION OF THE NATURAL GRASSLAND COVER BEGUN.

Establishment of fescue and Poa tussock in seed-bed prepared by growth and decay of scrubweed. Grey's Hill Station (The white patches seen in this photo and in Fig. 3 are snow)



FIG. 2. DOMINANT FESCUE-TUSOCK PHASE IN THE REGENERATION NOW PROGRESSING. GRAMPIAN'S STATION.

[Photos by E. B. Levy.]

sunshine on the baked surface, have not afforded seedling plants an easy opportunity to reassert themselves and thus reclothe the depleted areas. The prevailing climatic conditions cannot, however, be held primarily responsible for the decline of the native pastures, because even in the localities where depletion is seen at its worst, native grasses are reappearing with the retreat of the rabbit pest. This fact is indisputable, and its significance is of more than passing importance.

It has been pointed out by some observers of the inland native grasslands that the soil now dries out much more rapidly than it did formerly, and that aridity has greatly increased within comparatively recent years. That the soil is drier than formerly—in other words, that it has lost its moisture-retaining capacity—cannot be gainsaid, but the cause is not far to seek. With the disappearance of vegetation the former water-holding capacity of the soil has gone, with the result that the sparse rainfall is not retained, but mostly runs away into the natural watercourses. The dry belt extends up to slightly over the 2,500 ft. level, and on the more exposed situations serious depletion extends even beyond this elevation.

It is unfortunate that there are no definite records of the progress of events that have led up to the present state of the Mackenzie Country, and still more so that remedial measures were not taken at an earlier date. A certain amount of useful work has been done in connection with regrassing, however, and it may be of interest to state the position as it appeared to the writer during several recent visits to the region. To return after an absence of eight years, and to find instead of a still further stage in grassland deterioration a considerable improvement in many parts came as a most pleasant surprise.

The rabbit pest is not now in evidence as it was in 1921, and nature is at work in quite a remarkable manner, native grasses reappearing where the land was practically bare ten years ago. In many parts the scabweed (*Raoulia lutescens*) is thickly studded with vigorous young plants of comparatively recent growth (Fig. 1). The native blue-grass (*Agropyron scabrum*), blue-tussock (*Poa intermedia*), poa-tussock (*Poa caespitosa*), fescue-tussock (*Festuca Novae-Zelandiae*), *Poa Maniototo*, and wild-irishman (*Discaria tomatou*) are to be found in seed in places where formally depletion reigned supreme (Figs. 2, 3, 5). These grasses appear to reassert themselves readily with the disappearance of the rabbit, and regeneration will take place over large areas now that conditions are more favourable for plant-growth. The sheep returns reflect the improvement that has taken place, disclosing a healthy increase in the flocks. In 1922 the number of sheep in Mackenzie County was 455,888, while in 1928 the number had risen to 548,781, an increase of 92,893 in six years.

PROGRESS OF EXPERIMENTAL AREAS.

The activities of the Department of Agriculture in connection with regrassing work in the Mackenzie Country commenced in 1910, under the direction of Mr. A. Macpherson, then Fields Instructor at Christchurch. Several areas were fenced and plots sown with various grasses and other plants thought to be suitable for the prevailing climatic conditions. The areas at Whalesback and Haldon are still under the

control of the Department, and during a recent visit a careful examination was made of the introduced vegetation of these areas, also of a sowing that was made on the dark faces of Gallows Hill, Haldon, during September, 1921. This sowing has done remarkably well, and cocksfoot, yarrow, *Poa pratensis*, and some perennial rye-grass plants are in good healthy condition, despite the fact that sheep depasture on this block all the year round, and that at times the stocking is extremely heavy. Sowings made at the same time on the warm sunny slopes of the same run were not successful.

The Haldon experimental area was established in 1910, and various sowings were made at intervals until about 1915, and again in the spring of 1920. The plots that are showing up well are cocksfoot



FIG. 3. AREA NEAR BURKE'S PASS WITH POA AND FESCUE TUSsocks DOMINANT.

Most of this area has regenerated during the last few years. Numerous seedling tussocks show in foreground. This view is typical of the upland plains of the Mackenzie Country.

(Photo by E. B. Levy.)

(*Dactylis glomerata*), tall oat-grass (*Avena elatior*), *Poa pratensis*, Chewings fescue (*Festuca rubra* var. *fallax*), yarrow (*Achillea millefolium*), awnless brome-grass (*Bromus inermis*), lucerne (*Medicago sativa*), brown-top (*Agrostis tenuis*), sheeps' burnet (*Poterium sanguisorba*), and, in places, white clover.

The Whalesback area shows a most interesting growth of English wild white clover. This was sown in 1911, and now covers several acres of land. In places, in association with *Poa pratensis*, and in other parts with yarrow, it has formed a splendid sward which completely covers the soil (Fig. 4). Zigzag clover (*Trifolium medium*) was established in 1924 on this area by transplanting a few plants grown



FIG. 4. WHALESBACK EXPERIMENTAL AREA, SHOWING SPELLED PASTURE
Poa pratensis, brown-top, white clover, and Yorkshire fog are dominant here

Photo by E. B. Levy

from seed received from Canada. The growth has been prolific, and it promises to be quite a valuable variety for the inland plains. Cocksfoot, tall oat-grass, sheeps' burnet, various fescues, brown-top, red-top, and yarrow have all made good growth.

An extension of spring surface-sowing of the dark faces of the runs with cocksfoot, brown-top, yarrow, *Poa pratensis*, crested dogtail, and white clover seems to present opportunities for work along lines that promise to be highly successful. The surface sowing at Gallows Hill has certainly been successful, and this work is now more likely to have general success than formerly owing to more favourable general conditions.

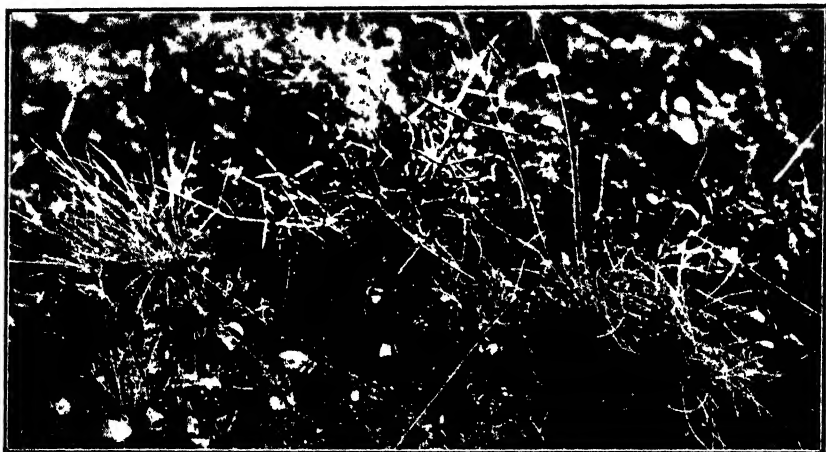


FIG. 5. BLUEGRASS (*AGROPYRUM SCABRUM*) AND WILD-IRISHMAN ESTABLISHING IN SEED-BED FORMED BY GROWTH AND DECAY OF SCABWEED. NEAR BURKE'S PASS.

[Photo by F. B. Levy.]

At Burke's Pass, the portal of the Mackenzie Country, is erected a monument to the discoverer of the Pass, on which is an inscription exhorting all intending settlers to plant trees. This is sound advice, and though some afforestation work has been done, especially near the Pass, suitable shelter-belts across these upland plains are still urgently required. Besides being of incalculable benefit to both man and beast, they would also afford shelter to the vegetation, and hasten the day both of the regeneration of the native grasses and establishment of exotic pasture.

Stale Cloths and bad Flavour in Cream.—A Farm Dairy Instructor reports: "I have found that a good deal of bad flavour in cream is caused through the use of stale cloths for washing separator parts and utensils, instead of using scrub-brushes. I have also found farmers using stale cloths through milk-pipes, thereby leaving a taint on the pipe which also reacted on the cream. These defects are very often not detected when the cream is delivered daily, but become prominent when it is delivered every second day.

MINERAL CONTENT OF PASTURES RESEARCH.

EXTRACTS FROM REPORT ON WORK FOR YEAR 1928-29.

(Continued.)

B. C. ASTON, Chief Chemist, Department of Agriculture

Phosphate Deficiency in Wairarapa Localities.

WORK in the Wairarapa district was continued during the year, and the results already obtained (see this *Journal* for October, 1928) have been confirmed—namely, that the poorer pastures of the district are among the lowest in phosphorus content that have been encountered in the course of this research—a fact all the more remarkable when it is considered that they are cow-pastures. The local farming public and agricultural officials have been warned that the deficiency is serious.

Analysis shows that the content of manganese is in some pastures unusually high, approaching 0.1 per cent. Mn_3O_4 on the dried sample. Pastures which have been top-dressed with superphosphate compared with the non-phosphated land on the same farm show great superiority in phosphorus content. Thus at Mauriceville the pasture on non-phosphated areas averaged 0.43 per cent. phosphoric acid, and on the phosphated fields it was 0.62 per cent. At Hamua it was 0.46 per cent. phosphoric acid as against 0.51 per cent. At Hukanui the non-phosphated land gave pasture which varied from 0.2 per cent. to 0.48 per cent. phosphoric acid, as against 0.7 per cent. for the phosphated land. At Masterton the non-phosphated pasture yielded 0.38 per cent. and the phosphated land 0.63 per cent. phosphoric acid.

As bearing on the incidence of disease and low phosphate content of the pastures it will be noted from the tabulated analysis that on hills near Masterton there was as little as 0.27 per cent of phosphoric acid in the non-phosphated pasture, and that "sleepy" sickness in ewes occurs here. The non-phosphated pastures on a farm at Hukanui, where Waihi disease occurs in cows, had only 0.2 per cent. of phosphoric acid. It will also be seen that the amount of calcium in these pastures was much higher in every case than that of phosphoric acid, and there is apparently no great deficiency of this element in the pasture that one may complain of as likely to have any adverse influence on the health of stock. This is as one would expect from the high clover content of most of the pasture.

NOTES ON THE SAMPLES ANALYSED (SEE TABLE).

Kaituna.

Nos. 6126-27 and 6175: The first two samples from this farm on the slope of the foothills of Mount Holdsworth are compared, and show the influence of phosphate dressings on the botanical and chemical composition of the cow-pastures. The sheep-pasture taken in the spring still shows both low phosphoric-acid and calcium content.

Dalefield.

Nos. 6330-31: The pastures from this farm show the phosphoric-acid content to be low, but the calcium and clovers are present in good amounts.

No. 6346: The low phosphoric-acid content of the pasture on this farm is correlated with much temporary sterility in the cows.

Upper Dalefield.

No. 6332: This pasture, never top-dressed, is extremely low in phosphoric acid.

Greytown.

Nos. 6136 and 6176: In the first sample, a thirty-year-old pasture, although white clover is dominant the phosphoric acid is extremely low. The swamp pasture is a much superior feed.

Belvedere.

No. 6137: A very weedy pasture abnormally low in phosphoric acid, resulting in the occurrence of Waihi disease in the cows. That temporary sterility is mitigated by the application of phosphates on this farm is an interesting but not unexpected result.

Featherston.

Nos. 6134-35: These are rich flat lands in which white clover is dominant in the thirty-year-old pasture, but in which the phosphoric acid is still too low.

No. 6172 and the following two are from farms yielding pasture with the highest phosphoric-acid content yet met with in the Wairarapa.

No. 6173: Another farm with pasture of high phosphoric-acid content, on low-lying country.

No. 6174: On this farm, in spite of the abundance of the clover, the calcium content appears to be lower than that fact warrants.

Mauriceville.

These lands are very near limestone outcrops.

Nos. 6128, 6341-42: From this farm the first two pastures are unmanured and taken in consecutive summers--February, 1928 and 1929. There is close correspondence in the result of phosphoric-acid determination. The estimate of 60 per cent. of clovers is probably too high.

No. 6342: As a result of phosphate manuring the phosphoric-acid content of this grass pasture has been considerably increased.

No. 6343-45: The phosphoric-acid content of the pasture on this farm is low, but evidently improved by liming.

Masterton.

Nos. 6326-27: These pastures, from an upland sheep-run, show abnormally low phosphoric-acid content, with various troubles in the wethers and ewes.

Nos. 6328-29: A farm where the pasture gives satisfactory results in the phosphoric-acid content, showing benefit from manuring with phosphates and with liming.

Nos. 6159-60: This pasture is both poor in phosphoric acid and calcium. One of the few cases of autumn pasture samples, and not much information concerning it.

Table 5.—*Analyses of Wairarapa Pastures (Phosphate Deficiency).*

The results are expressed as percentages (chemical analyses are calculated on the material dried to constant weight at 105° C. in electric oven.)

Lab. No.	Ash.	Crude Silica (SiO ₂)	Ferric Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnesic Oxide (MgO)	Manganese Oxide (Mn ₂ O ₃)	Chlorine	Nitrogen	Proteins	Sodic Oxide (Na ₂ O)	Potassic Oxide (K ₂ O)	Botanical Analyses.			Date collected.	Manurial Treatment.	Locality.
														Grasses.	Legumes.	Weeds.			
5126	7.44	1.75	0.025	0.081	0.36	1.05	0.43	0.045	0.66	2.13	13.3	0.10	1.86	60	30	10	1 2 28	1920 Top-dressed with 2 cwt. grass mixture per acre. 1928 Top-dressed with 2 cwt. super	Kaituna.
5127	6.96	2.52	0.022	0.077	0.20	0.89	0.49	0.045	0.54	1.11	7.1	1.06	0.97	60		10	1 2 28	Unmanured	Kaituna.
5175	8.91	4.21	0.040	0.157	0.45	0.60	0.32	0.057	0.51	2.49	15.6					13 10 28	Un-top-dressed	Kaituna.	
5330	11.05	2.45	0.039		0.64	1.57	0.57	0.042	1.00	3.00	18.8	0.41	2.00	18	40	12	19 2 29	Unlimited. Small dressings super in places	Dalefield.
5331	9.75	1.68	0.040		0.55	1.93	0.55	0.041	0.98	3.42	21.4	0.45	2.11	12	17	11	10 2 29	1921 Put down with 20-25 cwt. lime Annually treated in spring with 3 cwt. lime and in autumn 2 cwt. lime	Dalefield.
5332	7.11	2.54	0.017		0.24	1.00	0.46	0.064	0.01	1.31	8.2	0.26	1.63	75	1	21	19 2 29	Unmanured Surface-sown	Upper Dalefield.
5346	10.77	4.15	0.075		0.53	1.21	0.54	0.030	0.92	2.53	17.7	0.32	2.11	75	20	5	23 2 29	Manured last three years with 2½ cwt. super	Dalefield.
5136	9.26	2.84			0.11	0.94	0.66	0.098	1.18	2.45	15.3			10	60		1 2 25		Greytown.
5176	8.74	1.69	0.011	0.045	0.79	0.54	0.48	0.050	1.27	4.06	25.4					13 10 28	Unmanured	Greytown.	
5137	8.90	2.87	0.042	0.135	0.25	1.03	0.045	0.045	1.01	1.59	9.95			25		75	1 2 28	Un-top-dressed	Belvedere.
5134	10.99	2.74	0.060	0.180	0.63	1.53	0.72	0.047	1.27	3.34	20.9			60	40		1 2 28	1927 (June) 3 cwt. limestone and super	Featherston.

REMARKS

Lab. No.	REMARKS
6126	Wahiti disease. Pasture two-five year, old, rich in clover and lucern. Potatoes light-brown soil, on sandstone and shingle. In 1927 cows late in coming in season; fed with bran and super. First crop turnips badly affected with club-root.
6127	Florin dominant. Un-top-dressed paddock of No 6126 farm.
6175	Short sheep-feed; carrying a number of young cattle. Low foothills beneath Mount Holdsworth. Mossy and dry with little spring growth.
6330	Flooded annually and rather damp. Five cows out of twenty-five usually returning to bull. White clover and dragsail common.
6331	Fairly short and dry growth. Flat silty ground. Floods less than No 6330
6332	Very poor dry pasture from strong fern terrace. Only trace of clover.
6336	Temporary sterility very bad. Low-lying alluvial flats. Rather short and dry growth on grazed patches.
6130	Old pasture possibly thirty years. White clover dominant. Willows and poplars will not grow here.
6176	Old pasture—tall fescue, small rushes and sedges. Partly drained swamp. No trouble since feeding concentrates, bonemeal, and super.
6137	Grazed but not relished—75 per cent weeds. Wahiti disease. A paddock was top-dressed and opened to the rows, and with bran has resulted in the cows holding.
6134	Rich ground annually covered with silt from the Kuanahanga. Night paddock about thirty years old. Grazed very short, leaving only good sheep-feed.

Table 5.—*Analyses of Wairarapa Pastures (Phosphate Deficiency)*—continued.

(The results are expressed as percentages. Chemical analyses are calculated on the material dried to constant weight at 105° C. in electric oven.)

Lab. No.	Ash.	Crude Silica (SiO ₂)	Ferric Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnesic Oxide (MgO)	Manganese Oxide (Mn ₂ O ₄)	Chlorine	Nitrogen	Proteins	Sodic Oxide (Na ₂ O)	Potassic Oxide (K ₂ O)	Botanical Analyses		Date collected.	Manurial Treatment	Locality.
														Grasses.	Woods.			
6135	11.69	3.06	0.037	0.120	0.06	1.23	0.56	0.038	1.26	3.28	20.5			50		1 2 28	Un-top-dressed	Featherston
6172	11.26	2.10	0.065	0.163	1.14	0.79	..	0.026	1.23	5.43	33.9					13 10, 28	Unmanured	Featherston.
6173	11.93	2.52	0.124	0.340	1.16	0.76	0.44	0.023	1.22	5.31	33.2	..				13 10, 28	1926 and 1928 1½ cwt. super	Featherston.
6174	11.71	2.65	0.085	0.243	1.14	0.53	0.50	0.029	1.04	5.40	33.8					13 10/28		Featherston
6128	11.10	3.25	0.092	0.212	0.37	1.87			0.87	2.04	12.7			30	10	1 2, 28	Very little top-dressing. Unlimed	Mauriceville.
6341	8.67	2.15	0.026	..	0.44	2.59	0.35	0.030	0.99	2.13	13.3	0.28	1.73	54	20	22 2, 29		Mauriceville.
6342	10.06	1.69	0.026	..	0.64	1.94	0.51	0.049	0.81	2.91	18.2	0.22	2.9	44	34	22 2, 29	1924 . 4 cwt. super ..	Mauriceville.
6343	7.35	1.75	0.016	..	0.59	1.17	0.39	0.046	0.93	2.09	13.1	0.22	2.10	89	10	22 2, 29	1925 . 3 cwt. super 1927 . 2 tons lime and 3 cwt. slag. 1928 . 3 cwt. super	Mauriceville.
6344	7.29	1.84	0.017	..	0.47	1.03	0.44	0.033	0.93	1.99	12.4	0.12	2.27	88	10	22 2, 29	Unlimed. Manured as No. 6343	Mauriceville.
6345	8.48	2.71	0.016	..	0.44	0.90	0.52	0.101	0.91	2.00	12.5	0.14	2.21	88	7	22 2, 29	Unmanured ..	Mauriceville
6326	8.15	3.43	0.014	..	0.40	0.69	0.33	0.061	0.97	1.82	11.1	0.16	1.82	91	5	19 2, 29	Unmanured	Masterton.

REMARKS

Lab. No.	REMARKS
6135	Day paddock thirty years old. Grazed, but not so short as No. 6134
6172	clover similarly dominant
6173	Temporary sterility in 1927; eclampsia in 1928. Rich-looking pasture
6174	flat-swamp paddocks; green new growth. Old
6175	Dairied sixty years. Temporary sterility in 1927; eclampsia in 1928
6176	growth, young and green Swamp paddocks. Rich
6177	No trouble. Stocked heavier and more hay feed. Short, green, new feed, harder
6178	and poorer looking than Nos. 6172 or 6173 Alluvial stony flats. Abund-
6179	ance of white and subterranean clovers.
6180	Cows clean except for possibility of cystar ovaries. Four or five returned to
6181	bull. Pasture forty years old; white clover dominant. No calcium or
6182	phosphate fed.
6311	Very little trouble. Same as No 6128. Limestone soil. Medium growth;
6312	great mixture and green in places
6313	Low lying alluvial flats. Mixture of weeds, grasses, and clovers; rather long
6314	Pasture rather long and dry
6315	Unlimed paddock of No. 6343
6316	Similar growth to No 6343
6317	Native grasses, rather long, dry feed.
6318	Hull country, possibly limestone. Native grasses, rather long, dry feed.
6319	Undulating papa hills, sown from bush eighteen years ago. Pizzle-rot and
6320	trouble with fat lambs.

Mangamahoe.

No. 6335 : A neglected paddock, showing a very low phosphoric-acid content of the pasture.

Hamua.

Nos. 6129-30 and 6337 are pastures from the same farm. Those from the phosphated paddocks are much superior in phosphoric acid to that from the non-top-dressed paddocks.

No. 6337, taken in the same month a year later on a limed paddock, still shows the characteristic low phosphate content.

No. 6131 : The pasture of this farm shows low phosphoric-acid content in spite of top-dressing.

No. 6133 : The high proportion of clovers in this pasture and the low percentage of phosphoric acid is remarkable on this farm.

No. 6336 : This farm yields a pasture which contains the highest phosphoric-acid content yet found at Hamua. It is to be noted as significant that very little difficulty is experienced with the cows as regards breeding troubles.

The farms of this locality, except those on distinctly recent alluvial soils, are much affected with temporary sterility in the cows. The pastures of those farms which escape lightly or are at present immune from breeding troubles contain the most phosphoric acid of any, but the amounts present are still too low for normal cow-pastures. These low figures for phosphoric acid are remarkable considering the high clover content of the pastures. The calcium content of the Hamua pastures is uniformly high. The use of superphosphate for these pastures must be urgently commended, since those paddocks top-dressed with phosphates show a much higher phosphate content than those which have not been top-dressed. All of the pasture samples were more or less contaminated with earthy matters, so that the iron, alumina, and manganese figures are probably in excess of those actually occurring in the plant tissue.

Hukanui.

Nos. 6132, 6338, and 6339 : At Atea is a farm on which Waihi disease (bone malnutrition in cows) occurred, and here the extraordinarily low figure of 0.2 per cent. is obtained for the amount of phosphoric acid in the pasture. It is to be noted that here the clovers are absent and the calcium content sinks. The following year, in the same month, analysis of pasture shows a similar low phosphoric-acid and calcium content, and the clovers similarly deficient. Where the land has been top-dressed with phosphates after ploughing, phosphoric acid, calcium, and clovers in the pasture all show a healthy increase on this farm. Manganese is present in high amount in this example.

No. 6340 : At Nireaha, on a recent alluvial soil, a very high manganese content of the pasture is again met with. How far this is due to contamination of soil is difficult to say.

Eketahuna.

Nos. 6333-34 : These two pastures from the same farm show great differences in the chemical and botanical composition, and again draw attention to the need for heavy phosphating of the pasture. The high amount of phosphoric acid (0.85 per cent.) on the annually treated pasture, compared with the very low figure, 0.31 per cent., for the pasture which had only one dressing two years ago is most significant.

Table 5.—Analyses of Wairarapa Pastures (Phosphate Deficiency)—continued.

[The results are expressed as percentages. Chemical analyses are calculated on the material dried to constant weight at 105° C. in electric oven.]

Lab. No.	Ash.	Crude Silica (SiO ₂)	Ferrie Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnesium Oxide (MgO)	Manganese Oxide (Mn ₂ O ₃)	Chlorine	Nitrogen	Proteins	Sodic Oxide (Na ₂ O)	Potassic Oxide (K ₂ O)	Citrates	Botanical Analyses	Weeds	Date collected.	Manurial Treatment.	Locality.
6327	9.38	6.58	0.045	..	0.27	0.42	0.30	0.004	0.57	1.84	11.5	0.06	0.97	96	1	2	19, 2, 29	Unmanured	Masterton.
6328	9.41	2.82	0.045	..	0.63	1.58	0.60	0.043	0.80	2.54	15.8	0.28	2.34	51	36	10	19, 2, 29	1925: Sown with 15 cwt lime and super 1926: 2 cwt super 1927-28: 2 cwt super and Ephos (1:1)	Masterton.
6329	8.49	4.05	0.013	..	0.47	0.93	0.42	0.090	0.78	1.47	9.2	0.18	1.50	84	6	10	19, 2, 29	Unlimed and unmanured	Masterton.
6335	7.37	2.77	0.023	..	0.25	0.85	0.47	0.081	0.82	1.58	9.9	0.22	1.81	91	2	7	21, 2, 29	Unmanured ..	Mangamahoe.
6159	9.55	3.77	0.024	0.062	0.50	0.65	..	0.057	1.29	3.05	19.1	..	..	..	..	..	6, 1, 28	2 cwt super when sown	Masterton.
6160	11.40	3.32	0.030	0.126	0.61	0.73	0.089	1.66	1.96	12.2	..	..	..	..	..	..	6, 1, 28	Unmanured ..	Masterton.
6129	9.59	1.30	0.036	0.083	0.48	1.48	..	0.030	0.93	2.03	10.1	..	..	70	30	..	1, 2, 28	1925: Top-dressed with 3 cwt super. 1926: Top-dressed with 2½ cwt. super. 1927: Top-dressed with 2 cwt. super.	Hamua.
6130	9.60	1.60	0.025	0.050	0.29	1.17	0.55	0.028	1.11	2.15	13.2	..	..	70	30	..	1, 2, 28	Un-top-dressed	Hamua.
6131	9.31	1.37	0.043	0.130	0.38	1.18	0.69	0.022	0.84	2.51	15.7	..	..	..	..	..	1, 2, 28	Lined and top-dressed	Hamua.
6133	10.28	2.32	0.063	0.203	0.56	1.17	0.67	0.041	0.92	2.41	15.0	..	..	10	90	..	1, 2, 28	Un-top-dressed	Hamua.

REMARKS.

Lab. No.	Lab. No.	REMARKS.
6327	6129	Fifty years old. Sandstone formation. "Sleepy sickness" troublesome. Grazed by cows constantly returning to bull and cocksfoot dominant. Second crop swedes always a failure owing to club-root.
6328	6130	White and red clover dominant. Grazed short. rather dry. Unmanured paddock of No. 6129.
6329	6131	Same soil, &c., as No. 6328, but pasture got away to seed more sterility. Ploughed two years ago, put down cow-grass and rye-grass with 1½ ton ground limestone in autumn, and top-dressed in spring with 1½ cwt. super. Grazed by cows.
6335	6133	Stony alluvial flat. Cattle grazed. Brown-top prevalent. Richest farm in district: river silts land over yearly. No trouble till this year (1928). White clover 90 per cent. Small hay paddock top-dressed gave large growth.
6159		Seven years old. No trouble yet. Mainly cocksfoot and rye-grass; grazed by sheep.
6160		No trouble yet. Pasture not eaten down. Plateau

Table 5.—Analyses of *Wairarapa Pastures (Phosphate Deficiency)*—continued.

[The results are expressed as percentages. Chemical analyses are calculated on the material dried to constant weight at 105° C. in electric oven.]

Lab. No.	Ash.	Crude Silica (SiO ₂)	Ferric Oxide (Fe ₂ O ₃)	Alumina (Al ₂ O ₃)	Phosphoric Acid (P ₂ O ₅)	Calcic Oxide (CaO)	Magnesi Oxide (MgO)	Manganese Oxide (Mn ₂ O ₃)	Chlorine	Nitrogen	Proteins	Soil (Xide) (Na ₂ O)	Potassi Oxide (K ₂ O)	Botanical Analyses (Grasses, Legumes, Weeds)	Date collected.	Manural Treatment.	Locality.	
6336	9.56	1.30	0.028	..	0.68	1.53	0.62	0.019	1.13	1.00	25.0	0.10	2.04	58	37	1	21, 2 20 Autumn 1928, 3 ton burnt lime; spring 1928, 3 cwt. super. Previously 3 cwt. super for three years	Hamua.
6337	9.07	2.17	0.034	..	0.54	1.37	0.16	0.028	1.07	3.15	19.1	0.12	2.04	66	28	6	21 2 20 Lined	Hamua.
6132	7.41	2.95	0.056	0.167	0.20	0.86	0.32	0.028	0.10	1.05	10.3	..	..	50	..	59	1 2 28 Un top-dressed	Atea, Hukanui
6340	9.87	2.95	0.040	..	0.48	1.21	0.03	0.061	1.27	2.58	10.1	..	..	73	11	13	21 2 20 Unmanured	Nireaha, Hukanui
6336	9.27	2.36	0.035	..	0.69	1.12	0.57	0.090	1.20	3.12	20.7	0.04	2.10	77	11	0	21 2 20 Ploughed 1924, and 2-3 cwt. super annually since	Atea, Hukanui
6339	7.82	3.74	0.021	..	0.26	0.75	0.43	0.022	0.66	2.03	12.7	0.31	1.66	80	1	19	21 2 20 Unmanured	Atea, Hukanui
6333	8.06	2.13	0.015	..	0.31	1.05	0.12	0.051	0.04	1.00	11.9	0.31	2.07	79	6	15	20 2 20 Unmanured	Atea, Hukanui
6331	10.50	1.92	0.032	..	0.85	1.00	0.50	0.028	1.27	1.95	25.3	0.58	2.03	51	13	7	20 2 20 Put down 1922 with 2 cwt. agricultural lime and manure. 1923-25 2 cwt. slag annually, 1926-28, 2 cwt. slag and 3 cwt. burnt lime annually. 1924, 2 cwt. super also	Eketahuna.

REMARKS

Lab. No.	Remarks
6336	Very little trouble and red clovers dominant.
6337	Short rather dry feed with many thistles.
6132	Wah disease, 1927; none 1926. Light foam on sandstone and shingle, with western aspect. Bush country. Fern and moss dominant. Top-dressing makes clover come away well.
6340	Stony alluvial flats. Cocksfoot dominant.

Samples collected by R. E. R. Grimmer and C. M. H. Wright. Chemical analyses by B. C. Aston, Misses Kidson and Strand, and assistants. Botanical analyses of Nos. 6132 to 6130 and 6132 to 6137 estimated by C. H. Wright in field; others done in laboratory.

ERRATA.—In Table 1, p. 21, July Journal, the last three constituents—ferric sesquioxide, aluminium sesquioxide, and calcic oxide—should also read as present in crude silica. In heading of Table 3, page 21, Calcic oxide (CaO) should read Calcic oxide (CaO).

DRY-ROT OF SWEDES.

SOME FIELD OBSERVATIONS AND EXPERIMENTS ON CONTROL.

J. C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

IN G. H. Cunningham's bulletin, "Dry-rot of Swedes and Turnips: Its Cause and Control*," it is demonstrated by laboratory methods that the disease is carried in the seed, and that such seed can be disinfected by soaking for one hour in a 0.25 per cent. solution of Semesan held at 115° F. Subsequent laboratory experiments showed that the same result could be obtained by soaking the seed cold for one hour, followed by five minutes at 115°, both in 0.25 per cent. Semesan solution. The latter method proved quite harmless to the vigour of germination of even weak seed, and had the advantage of being much simpler to carry out on the average farm.

During the last three years swede-seed has been treated by one or other of these methods for approximately two hundred crops scattered over New Zealand. Following treatment, most of it has been tested for disinfection by Cunningham's method of plating on media ten samples of one hundred seeds from each treated lot, and, though in the aggregate some ninety-five thousand treated seeds have been so tested†, not one dry-rot-infected seed has been found. Nevertheless, the large majority of these crops developed dry-rot, and, where a comparison could be made, usually to the same extent as in the crops from the same seed untreated. It follows, then, that either the seed was not completely disinfected, and that the laboratory tests failed to disclose this fact, or that the crops became infected from some other source.

The most obvious possible source of infection apart from the seed would be a previous crop of swedes or turnips grown or fed on the same land; but this contingency had been carefully guarded against with nearly all the crop examined. Other possible sources of infection are wind-borne spores from distant centres of the disease; continued existence of the dry-rot fungus in the soil for two or more years in the absence of its normal host-plants; presence of the fungus on other hosts than crop brassicas; carriage of the spores from diseased to healthy plants by insects, birds, animals, or man.

Cunningham has shown that dry-rot spores rapidly lose their power of germination when dried out from the gelatinous matrix in which they are extruded, so that wind-borne infection is not likely over long distances. Moreover, the spread of infection within a crop is of a localized or contact type, very different from the generalized dispersal of crop-diseases known to be air-borne.

In regard to the possibility of the fungus carrying over in the soil, Cunningham concludes that infection from this source is not usual. The field evidence appears to support his view, especially the observed

* Bulletin No. 133, New Zealand Department of Agriculture, 1927. (Abridged in this *Journal* for July, 1927.)

† All tests for disinfection were carried out by R. Brien, Culture Specialist for this Station.

fact of crops grown on virgin land carrying approximately an equal amount of dry-rot as those from the same seed grown elsewhere.

The third possibility—that the disease occurs on other host-plants in New Zealand—has as yet received no supporting evidence either in the laboratory or in the field, in spite of five years' search for such an occurrence. The only plants on which the disease has been recorded in New Zealand are swede, turnip, and cabbage, and on the last-named it is exceedingly rare.

There remains the possibility that the disease is carried from one swede crop to another by insects, birds, animals, or man. It is probable that within the boundaries of any particular crop these comprise the main agencies by which infection is spread, but they cannot account for the observed distribution of diseased crops in the field. We have had crops grown in many different localities in both Islands from the same sample of seed and though the total loss due to the disease might vary with date of sowing, climate, cultivation, &c., the percentage and distribution of the characteristic primary dry-rot patches would remain approximately the same throughout.

The field evidence thus appears to confirm Cunningham's contention that the main primary source of dry-rot infection is carried in the seed, but at the same time it strongly suggests that the seed is not disinfected by the method he advocates or by the modified method given above. It seems probable that the laboratory tests of disinfection, on the apparent success of which both methods were based, failed to disclose the extremely minute percentage of seed which, in the commercial samples used, was capable of producing the disease in the field.

The present article records certain results of a series of treatments of one sample of high-grade English swede-seed carried out during the past season at the Plant Research Station, Palmerston North.

The experiments failed to afford definite evidence as to the success or otherwise of disinfection by the methods tried because of the reasonable doubt as to whether the first-found dry-rot lesions arose from seed sown at those particular spots or not; further, it is doubtful whether the absence of lesions from any particular treatment had any significance, in view of the small number found in the untreated controls. The chief value of the experiments lies in providing a record of the spread of dry-rot infection in a crop, and in the indications they give as to the lines of future work.

What is wanted now are supplies of swede-seed (1) from plants free from dry-rot, and (2) from plants heavily infected with dry-rot. It would then be possible to test whether under ordinary New Zealand field conditions clean seed produces a clean crop and infected seed a diseased crop. In the meantime, as a working basis for further disinfection experiments, it is justifiable to assume on the present evidence that diseased seed will produce diseased plants in the field. The present work shows that either such experiments must be carried out on a much more elaborate scale, both in regard to number of plants and to isolation of each treatment, or that seed much more heavily infected than the ordinary commercial sample must be used.

Selected bulbs are now growing at this Station, both under glass and in the open, in an endeavour to produce both disease-free and heavily diseased seed-heads—the latter by methods of artificial inoculation.

PARTICULARS OF EXPERIMENTS.

Area I.

The land, broken out of part lucerne, part grass, in April, 1928, had not carried brassicas for at least seven years; there were no brassica crops within a mile, but several small household vegetable-gardens within that radius. Manuring was with superphosphate, broadcast at 3 cwt. to the acre. The seed was sown with a Planet Jr. drill on 6th November, in rows 2 ft. apart. Germination was uniformly excellent, approximately 2,000 plants per row developing to first main-leaf stage. At the end of November the plants were thinned to 8 in. apart, leaving 350 plants per row. (The short control row 37 was left unthinned.)

No sign of dry-rot was detected on frequent inspections until 15th January, 1929, when six individual plants showing typical leaf lesions were found at the spots marked on the plan (Fig. 1). The diagnosis was confirmed in cultures, and one of the plants (shown on plan in Row 11) pulled and replanted in the open at the laboratory developed typical bulb dry-rot within a few weeks. By 8th February bulb lesions were becoming common in the vicinity of the first-found leaf lesions. It was decided then to test the possibility of getting rid of the disease by the removal of all infected plants. Careful weekly examinations were made with this end in view, the position of each infected bulb being recorded, together with the date of detection and removal. The plan shows graphically at three salient dates how the disease had spread, and, incidentally, how hopeless is an attempt to check it by this means. It is probable that the spread of infection was helped by the traffic and handling of the plants necessitated by the frequent inspections, but a study of the spread week by week, and the obvious attraction to insects of spore-producing lesions, suggest very strongly that insect carriers are the main source of fresh infections.

Seed Treatments.

Row No.		
6	12 hours in water plus 5 minutes in Semesan at	131°
7	"	127°.
8	"	123°.
9	"	119°
10	"	115°.
11	1 hour in Semesan plus 5 minutes in Semesan at	135°.
12	"	133°.
13	"	131°.
14	"	129°.
15	"	127°.
16	"	125°.
17	"	123°.
18	"	121°.
19	"	119°.
20	"	117°.
21	"	115°.
22	20 seconds in Semesan at	170°.
22A	Not sown.	
23	60 seconds in Semesan at	160°.
23A	50	160°.
24	40	160°.
24A	30	160°.
25	20	160°.
25A	10	160°.
26	60	155°.
26A	50	155°.

Seed Treatments—continued

Row No.			
27	40	seconds in Semesan at	155°.
27A	30	"	155°.
28	120	"	150°.
28A	100	"	150°.
29	80	"	150°.
29A	60	"	150°.
30	50	"	150°.
30A	40	"	150°.
31	30	"	150°.
31A	20	"	150°.
32	10	"	150°.
32A	120	"	145°.
33	100	"	145°.
33A	80	"	145°.
34	Dusted with Semesan		
34A	Dusted with U T 871.		
35, 36, 37	Control untreated		

Semesan solutions at strength of 0.25 per cent. Temperature of presoak, 55°-60°. All temperatures Fahrenheit

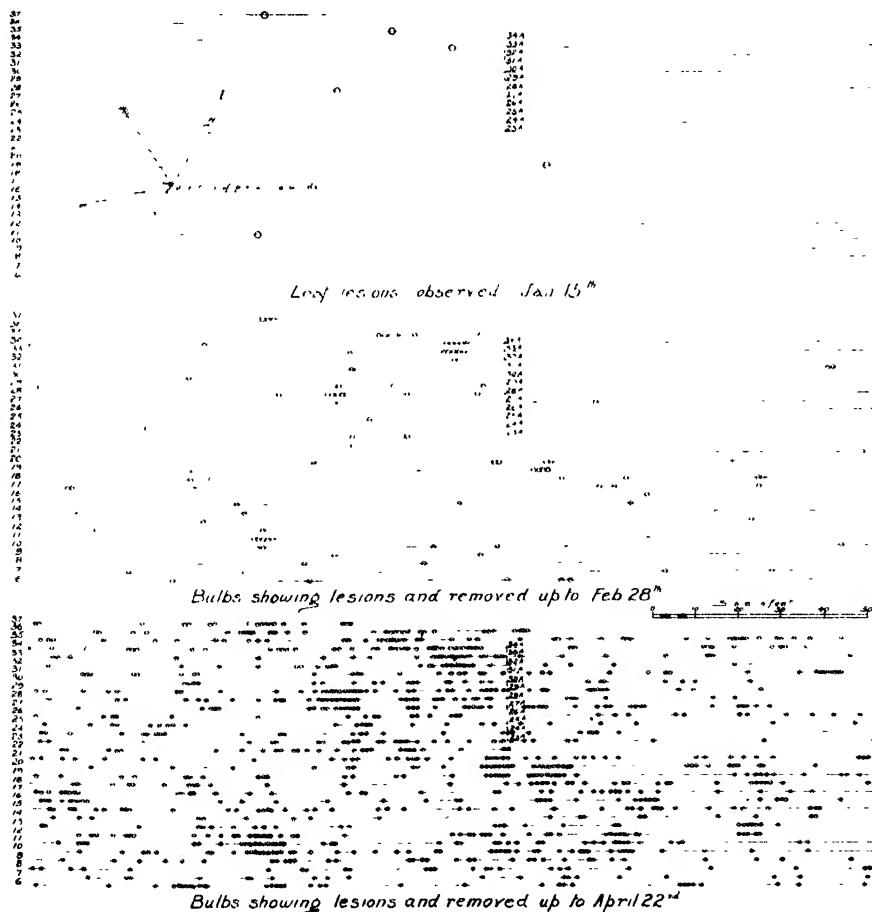
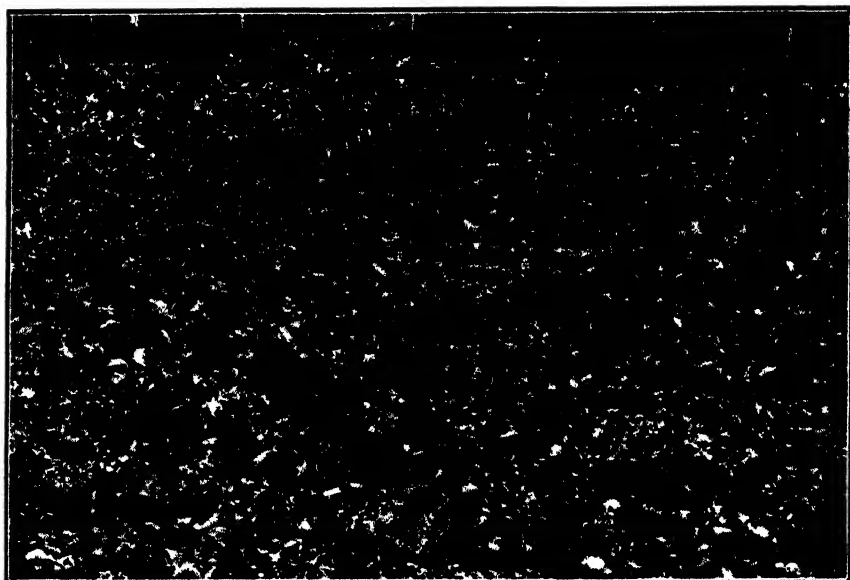


FIG. I. PLAN OF AREA I, SHOWING PROGRESS OF EXPERIMENT.



CENTRAL PART OF AREA 1 IN MAY, SHOWING VACANT GROUND FROM WHICH DISEASED PLANTS HAVE BEEN REMOVED.

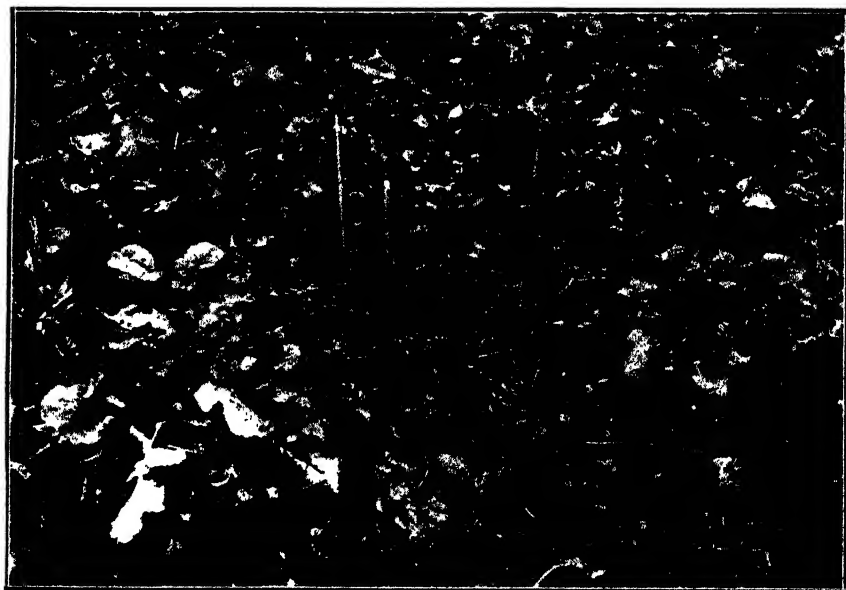


FIG. 3. TYPICAL DRY-ROT PATCH IN AREA 1.
Stake in centre marks position of first diseased plant found.

[Photos by H. Drake.]

Area 2.

A further series of treatments, using the same line of swede-seed, was sown on 8th December on land broken out of old pasture, some two miles away from Area 1. The crop was not thinned, was hand-hoed once only between the rows, and inspected twice, when no dry-rot lesions were found. On 8th May all the plants were pulled and examined. The plan (Fig. 4) shows the location of the dry-rot lesions found. At the spot marked by the large circle, in Row 24, one small bulb was almost completely rotted away and the adjoining bulb partially so. The other infected bulbs, in Row 24 and in Rows 22 and 27, showed only small lesions at old leaf scars on the neck. These almost certainly would be secondary infections caused by spores which had germinated in the axil of the leaf.

It appears, then, that in this whole block, containing 5,500 plants, only one primary centre of dry-rot infection occurred.

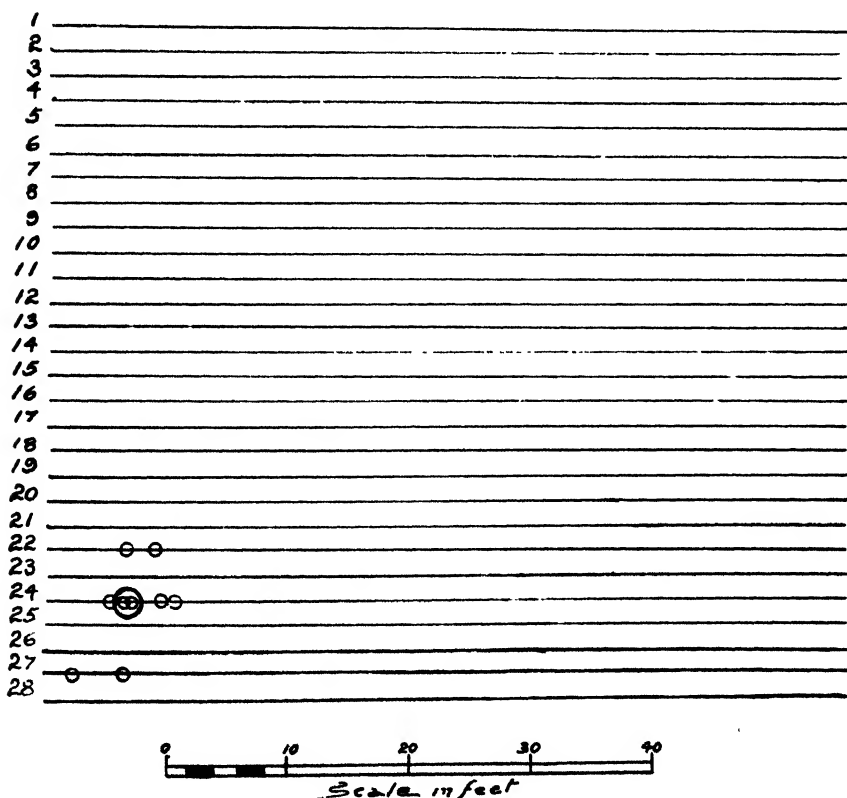


FIG. 4. PLAN OF AREA 2, SHOWING LOCATION OF DRY-ROT LESIONS FOUND

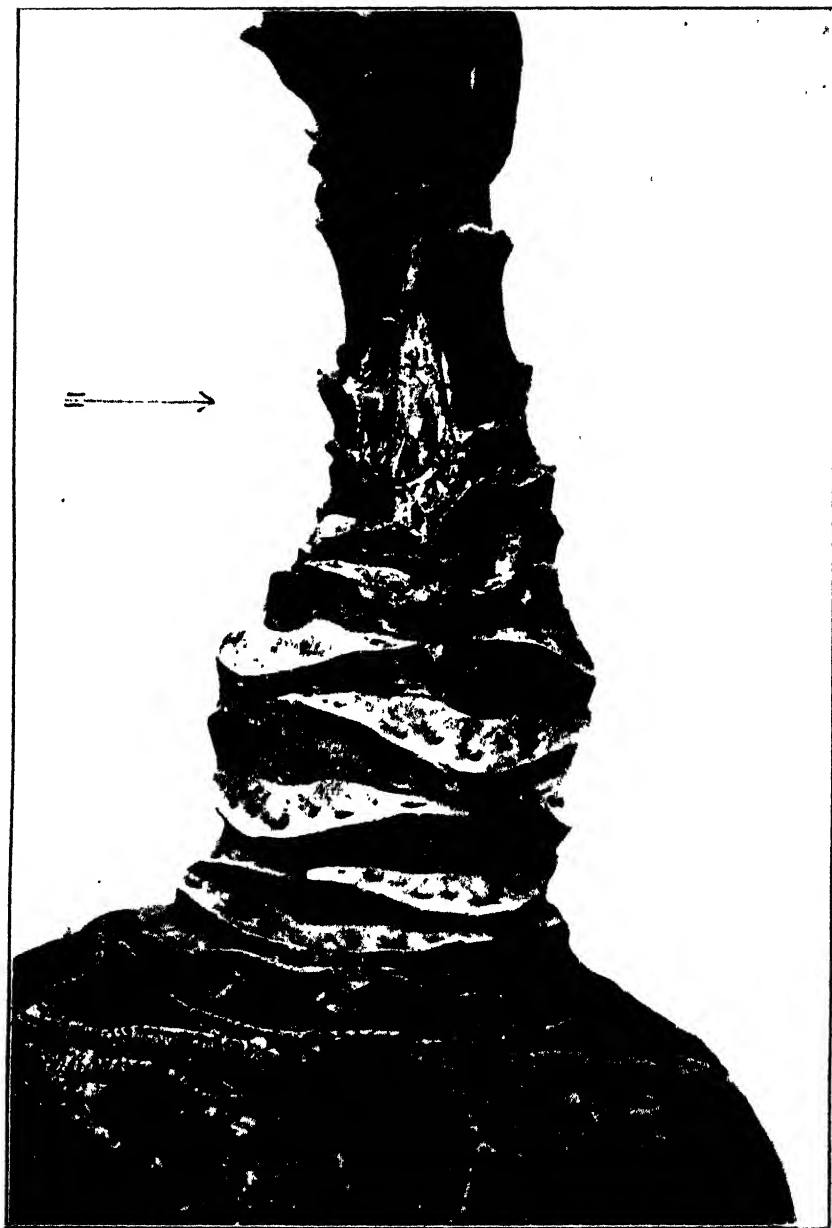


FIG. 5. COMMON FORM OF LATE DRY-ROT INFECTION STARTING IN LEAF AXIL.

[Photo by H. Drake.

Seed Treatments (Area 2).

Row Nos.	Dip in 0.25 per Cent. Semesan.		Number of Plants
1 and 2 .. ..	.. 10 minutes at	155°	0
3 " 4 .. ..	.. 5 " "	155°	0
5 " 6 .. ..	.. 10 " "	150°	0
7 " 8 .. ..	.. 5 " "	150°	0
9 " 10 .. ..	.. 10 " "	145°	0
11 " 12 .. ..	.. 5 " "	145°	0
13 " 14 .. ..	.. 5 " "	143°	48
15 " 16 .. ..	.. 5 " "	141°	431
17 " 18 .. ..	.. 10 " "	139°	179
19 " 20 .. ..	.. 5 " "	139°	773
21 " 22 .. ..	.. 5 " "	137°	934
23 " 24 .. ..	.. 10 " "	135°	779
25 " 26 .. ..	.. 5 " "	135°	1097
27 " 28 .. ..	.. Untreated	.. ..	1275

All dipped following 1 hour presoak in 0.25 per cent. Semesan

SUMMARY OF EXPERIMENTAL RESULTS.

(1) The treatment of swede-seed by soaking for one hour at 50° to 60° F., followed by dipping for five to ten minutes up to 135° F., both in a 0.25 per cent. solution of Semesan, did not prevent the appearance of dry-rot in the field. With the five-minutes dip, field germination was seriously affected only above 135° F.

(2) It is not practicable to free a swede crop from dry-rot by eliminating diseased plants.

(3) In an early-sown swede crop which has been well grown, and properly thinned and cultivated, dry-rot infection may spread over the entire crop before the winter from a very few original sources of infection.

(4) Late sowing, lack of thinning, and poor cultivation, with consequent poor crop of small crowded bulbs, appears to reduce greatly the incidence of dry-rot.

This confirms the observations of E. B. Levv*, and the experience of many farmers who deliberately choose the smaller yield obtained by sowing thickly after midsummer, rather than the almost certain loss of the better crop obtained by sowing earlier with better treatment.

* " Investigation of Dry-rot of Swedes: Preventive Control by Farm Management " This *Journal*, vol 24, p 336, June, 1922.

Maturity of early-made Cheese—In advices received from Mr. W M Singleton, Director of the Dairy Division (now visiting Europe), he makes the following recommendations for improving the maturity of cheese made during August and September, also for safeguarding against soft crowns: (1) That factories install steam-heating pipes in curing rooms to control the curing-temperature at from 65° to 68° F.; (2) that the curds be properly cooked and not oversalted in manufacture; and (3) that all cheeses be so made that each will have not less than ½ in. of air-space on the top in each compartment of the crate.

STATIONARY SPRAYING SYSTEM FOR VINEYARDS.

EXPERIENCE AT TE KAUWHATA HORTICULTURAL STATION.

T. E. RODDA, Manager, Te Kauwhata Horticultural Station, Lower Waikato.

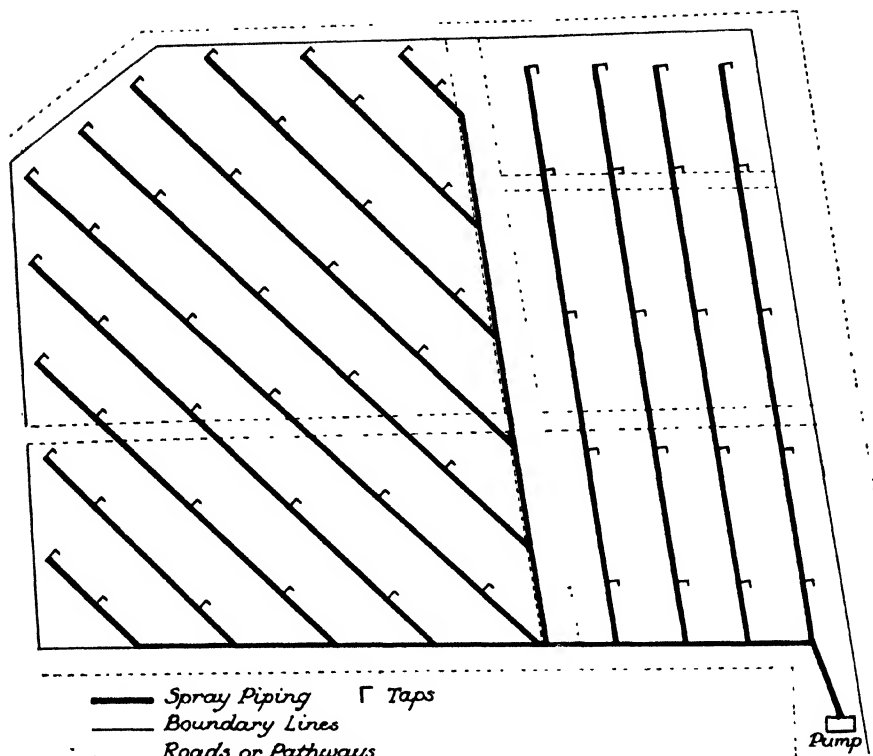
THE stationary or pipe system of spraying has become very popular in many of our New Zealand fruitgrowing districts during the last few years, having many advantages over the older method of spraying with portable outfits. The system, however, was not applied to vineyards in this country until two years ago, and the first plant appears to have been installed in the Agriculture Department's vineyard at this Station. This vineyard occupies an area of 20 acres of undulating country facing north-east, and is laid out so that the rows of vines obtain the full advantage of the sunshine.

As no information could be obtained regarding the use of such a plant in any other country the Department had no data to work on, and the plan that was eventually adopted must be considered as a partially experimental one. After a good deal of study it was considered that the most effective and cheapest way would be to lay the main pipe lines underground at the lower ends of the rows, and place the lateral lines on the tops of a number of the trellises, which are 3 ft. 6 in. high. Lateral lines were placed on every eleventh trellis, and suitable taps to connect the spray-hoses were placed on each lateral. Starting from the main line in each case, the first tap was placed at 84 ft., and the others at intervals of 168 ft. apart. Galvanized $\frac{3}{4}$ in. piping was used for all the main lines, and for an average of one-third of the length of each lateral line; $\frac{1}{2}$ in. piping was used for the remainder of the system. The accompanying plan shows the lay-out of the piping, of which a total of 9,000 ft. was used.

PUMP AND MOTIVE POWER.

During the spring of 1927 a triplex pump was installed, and it was driven by a 5 h.p. oil-engine. This combination proved thoroughly efficient, providing just sufficient pressure at 250 lb. to the square inch for four men using large nozzles. However, when electric power was reticulated through the district in the following year it was considered advisable to install an electrically driven plant. A three-cylinder pump, with a 10 in. by 48 in. air-chamber connected by silent chain drive to a 5 h.p. asbestos-protected ball-bearing motor, was chosen. This pump has a capacity of 16 gallons per minute at 500 lb. pressure.

This plant was operated for the whole of last season and gave great satisfaction, maintaining a steady pressure of 250 lb. per square inch, which I consider sufficient for vineyard spraying. Four men only were employed spraying at one time, but, judging from the volume of fluid returning to the tank, sufficient spray could have been delivered at the nozzles to keep eight men employed, provided that not more than one hose with two nozzles was attached to any one lateral line.



DIAGRAMMATIC PLAN OF PIPE SYSTEM AT TE KAUWHATA.

Provided the pump is functioning properly, there appears to be no difficulty in maintaining an efficient pressure in any section of the pipe system. Working at a gauge register of 250 lb. to the square inch, efficient pressure was obtained at the most distant point 500 yards from the pump. What the variation would be between the two points has not been tested.

HOSES AND METHOD OF OPERATING.

Hoses 120 ft. long were used for spraying. Two types were employed—a braided flexible hose of $\frac{3}{8}$ in. diameter and a seven-ply one of $\frac{1}{2}$ in. These hoses were first equipped with one nozzle for manipulation by one man, but in actual practice they were found too heavy for comfortable working. A strong Y connection was therefore fixed at the discharge end of each hose, and two 9 ft. lengths of additional hose were joined on to the double end of the Y, so as to enable two men to operate a nozzle apiece off one main lead, and thereby reducing the weight by 50 per cent. for each operator. This method answered well and did not overtax the men.

The method of operating is as follows: The hose is laid out alongside the fifth row from a lateral pipe-line, the connection end screwed on

to the first tap, and the pressure turned on. Each man picks up his lead of hose connected to the Y, opens the cock to admit the spray to the nozzle, and walks slowly up the row, spraying his side until a point half-way between the first and second taps is reached. The spray is then cut off from both nozzles, and one man grasps both spray-rods behind the turn-off cocks, while his mate walks back and seizes the hose about 12 ft. below the Y junction, and between them they give the hose a swing over into the next row. The man in charge of the nozzles then steps over the trellis after the hose and picks up both spray-rods, and with one rod in each hand starts spraying both sides as he walks down the row. Meanwhile the second operator proceeds down the row, places the remainder of the hose over the trellis, himself steps over, and returns to join his mate as he is beginning to feel some weight from the hose. Thus work proceeds until eleven rows (that is, five rows each side of the pipe-line) for the section of 168 ft. is completed. The hose is then unscrewed and transferred to the next tap on the pipe-line, and so on until the whole of the rows served by that particular pipe-line are sprayed.

The action of drawing the hoses across the trellises wears them out very rapidly, especially the braided pliable ones. The heavier types, although somewhat harder to handle, stand the strain better. All hose clips and fastenings must be of the best types and quality, to prevent blow-outs and leaks. Wiring does not give very satisfactory service.

ADVANTAGES OF STATIONARY SYSTEM.

After two years' practical experience I have come to the conclusion that on land of an undulating and heavy nature, such as at Te Kauwhata, a stationary spraying plant is 100 per cent. more effective than a portable one. Following are the reasons:—

(1) Spray can be applied when soil conditions are such as to render the use of a portable plant impossible without doubling the horse-power to pull it over wet land.

(2) The stationary system eliminates the packing of the soil that always occurs on clay land when horse-drawn outfits are used when the soil is wet or waterlogged.

(3) It enables the sprays to be applied quickly and at the correct time.

(4) It is not necessary to employ an experienced mechanic to operate an electrically-driven outfit. Ordinary labour can be used effectively on the job.

Triona Summer Oil for Spraying.—The Orchard Instructor for Hawke's Bay reports: "This oil was used by several growers during the past season, mostly at a strength of 1-80. Quite a satisfactory kill of red mite was secured at this strength. However, within four or five days young mites were becoming prevalent. I would conclude from these results that the fertility of the eggs is not destroyed, and that further applications of the oil would be necessary at intervals of perhaps fourteen days."

CONTROL OF BROWN-ROT IN STONE-FRUIT.

THE HENDERSON EXPERIMENTS WITH PEACH-TREES, 1925-29.

W. H. RICE, Orchard Instructor, Auckland.

EXPERIMENTS were instituted some years ago by the Horticulture Division, in co-operation with Dr. R. H. Makgill, at his Lincoln Road orchard, Henderson, on the control of brown-rot (*Schlerotinia cinerea*) in stone-fruits. The following notes review the results to date.

SEASON 1925-26.

The peach-orchard was divided into two blocks for preparation sprays, and treated, as the buds began to swell, with lime-sulphur, 1-15, or bordeaux, 5-4-50, respectively. Each block was again divided and received summer treatment, which gave as a test lime-sulphur versus atomic sulphur, and versus a combination of both, each on the respective base spray of lime-sulphur or bordeaux.

No variation in results in brown-rot control was found due to the base sprays, though bordeaux was found preferable to lime-sulphur as a control of leaf-curl. Bud-rot, twig-rot, and blossom-rot were modified but not fully controlled by any of the sprays applied. Satisfactory control of summer fruit-rot was secured by atomic sulphur, 8 lb. to 100 gallons. Atomic sulphur plus lime-sulphur showed a reasonable control. Lime-sulphur was not satisfactory as a control, and lowered the health tone of the trees.

SEASON 1926-27.

The base spray in this season was bordeaux, 5-4-50, over the whole area, which was then divided into three sections, each being sprayed five times—at pink and petal-fall, after three weeks, three weeks later again, and one week prior to fruit-ripening, respectively—with atomic sulphur, 10 lb. per 100 gallons, Sulpho, 10 lb. per 100 gallons, and a preparation locally known as “dry-mix.”*

The results obtained showed that bud-rot, blossom-rot, and twig-rot were not fully controlled by any of the sprays applied. Varietal resistance proved to be a factor, showing little loss with Paragon, while Golden Queen suffered extensive loss. Summer fruit-rot was well controlled by all sprays. Dry-mix gave the best control, while the growth and foliage on this section was outstanding in luxuriance and general healthy tone.

* The recipe for the dry-mix spray is as follows: Take 16 lb. fine powdered sulphur, 5 lb. fresh rock lime, and $\frac{1}{2}$ lb. casein. Wet the casein and dissolve it with $\frac{1}{4}$ pint of caustic-soda solution. Stir well, and bring the mixture to the consistency of milk by making it up to 1 gallon with water (caustic-soda solution is made by dissolving 1 lb. caustic soda in 1 gallon of water). Sift the sulphur and make it into a paste with water; add the gallon of dissolved casein and as much more water as is necessary to bring it to the consistency of cream. Slake the lime carefully and dilute the milk to 10 gallons with water. Strain it into the spray-tank, start the agitator working, add the “creamed” sulphur, and make the spray up to 100 gallons with water.

SEASON 1927-28.

The base spray—bordeaux, 5-4-50—was used and the summer sprays continued as in the previous season (atomic sulphur, Sulpho, and dry-mix), but on different sections of trees, in order to test out environment and usefulness under various seasonal weather conditions. A summary of the results obtained shows that brown-rot continued to manifest itself in several forms according to season, as follows:—

Bud-rot: This form takes exceptional toll of buds, and has been noted as reducing by 60 per cent. the possible crop as indicated by bud-development. This was not lessened or controlled by any of the sprays used. Varietal resistance proved the main factor.

Blossom-rot: Flower-infection resulted in the loss of up to 20 per cent. of the blooms according to variety, and was not amenable to any sprays used.

Twig-rot: Many fruiting laterals are affected by this form, though the main loss is of soft young growth. It was uninfluenced by any spray used. Varietal resistance proved to be a factor, though a more readily controllable factor is density of tree. Pruning should aim at opening up and spacing trees prone to bushy habits.

Fruit-rot: This may develop at any stage of growth, but unless under a damp atmosphere does not normally show up until the fruit is nearing picking-maturity. A table showing the rainfall in the period of fruit-development will be found at the end of this article, and discloses a rather large number of days on which rain fell. Without summer sulphur sprays the district average loss of crop due to this form is estimated at 40 per cent. With all the forms of sulphur used good results were obtained, and the infection reduced to $\frac{1}{2}$ per cent. in the case of dry-mix, while in no instance did the loss exceed 7 per cent. All sprays used had a beneficial effect on the general health of the trees, giving robustness of growth and foliage.

SEASON 1928-29.

Further investigations being advisable with a view to reducing bud-, flower-, and twig-rot, the experiment was conducted on a base of late autumn bordeaux, 8-6-40, applied in June to half the block, and bud-movement bordeaux, 5-4-50, to the other half. These sprays proved to have no influence on brown-rot control, but both proved equally effective in the control of peach leaf-curl.

Pruning: The usual form of pruning, which is on a long-short principle (with every lateral and leader tipped either long or short), was modified on half the area, including all varieties to the extent of leaving laterals untipped, though in each instance the leader was shortened and surplus laterals cut out. Checks showed that bud-, blossom-, and twig-rot were rather more prevalent on the untipped laterals than on those tipped. This type of pruning, from a wood-renewal standpoint, is not to be recommended for Paragon, while with other varieties little was gained, except with Carmen, which responded well, though in all varieties the highest-quality fruit was carried by tipped laterals.

Early sulphur spray: One line of trees of mixed varieties received an additional spray with dry-mix at the burst of bud. These showed

to no advantage alongside others not so treated, and this confirms other observations that sulphur works best during the warmer weather.

Summer sprays : Four applications of dry-mix were made respectively over the whole area, at pink, three weeks later, fruit half-grown, and one week prior to ripening, thus reducing the number of summer sprays by one as compared with previous seasons, when this mixture had given satisfaction. Good control of fruit-rot was attained, the loss being negligible.

Bud-, flower-, and twig-rot were less prevalent this season than for some years past. This lesser infection cannot be attributed to any special precautionary spray, as observations showed it to be constant over all sections. Conclusions are that the strict sanitation practised in this orchard has a decided influence for good. No infected fruit is allowed to remain on the trees or to come into contact with other fruit in the picking-containers. All infected fruit is properly destroyed. During pruning all diseased or doubtful wood is removed and destroyed, even small twigs not being allowed to remain on the ground or to be turned under.

GENERAL.

A review of the four seasons' experiments shows that brown-rot in peaches can be controlled by strict orchard sanitation and the application of dry-mix sulphur during summer. Some loss is experienced from the early-season forms of brown-rot, which are not so amenable to treatment, but the more devastating fruit-rot form is reduced to a negligible point.

The programme recommended for a season's peach-spraying is as follows :--

At bud-movement : Bordeaux, 5-4-50 ; followed immediately by oil, 1-17, as an insecticide

At pink stage : Dry-mix, 16 lb. to 100 gallons ; followed three weeks later by dry-mix, 16 lb. to 100 gallons

At fruit half-grown stage : Dry-mix, 16 lb. to 100 gallons

One week prior to fruit ripening . Dry-mix, 16 lb. to 100 gallons

A feature of the sulphur spray is that the foliage is retained in such good order and capable of building up the tree after the crop is removed. The general improvement of the orchard is indicated by the accompanying table of crop returns over a period of years, which, while disclosing

Crop Returns—Paragon Variety.

Season.	Number of Trees.	Number of Marketable Cases.	Average per Tree in Half-bushel cases.
1920	160	444	2 $\frac{3}{4}$
1921	160	78	$\frac{1}{2}$
1922	160	639	4
1923	160	730	4 $\frac{1}{2}$
1924	160	254	1 $\frac{1}{2}$
1925	150	953	6 $\frac{1}{2}$
1926	150	562	3 $\frac{3}{4}$
1927	147	1,010	6 $\frac{3}{4}$
1928	147	429	3
1929	147	987	6 $\frac{1}{2}$

an alternate crop variation, shows a decided improvement on returns obtained previously. The variety Paragon was selected for this table as the trees have been of mature stature for the whole period, and for the further reason that they are the principal variety grown in the Henderson district.

The trees used as a groundwork for the tests were of the varieties Paragon, Carmen, J. H. Hale, Hay's Cling, Golden Queen, Ideal, Wallace's Best, Yates Cling, Alton, and Delicious.

Rainfall at Location of Orchard during Period of Fruit-development.

Season.	December.		January		February.		March.	
	Amount.	Days.	Amount.	Days	Amount	Days	Amount.	Days.
	Inches		Inches.		Inches.		Inches.	
1925-26	1.78	19	5.64	18	3.15	19	3.41	13
1926-27	8.38	21	1.30	14	4.71	15	5.53	20
1927-28	1.32	18	0.17	5	2.12	10	4.42	18
1928-29	5.20	20	1.88	17	0.28	8	5.89	22

The writer desires to record thanks due to Dr. R. H. Makgill for his hearty co-operation in these tests, and to Mr. A. Schramm, orchard manager, for so carefully conducting the work.

WEEDS AND THEIR IDENTIFICATION.

BLACK NIGHTSHADE (*SOLANUM NIGRUM* L.).

ESMOND ATKINSON, Department of Agriculture, Wellington

BLACK NIGHTSHADE belongs to the same family as the potato and tomato (Solanaceae), which consists of about fifteen hundred species and is most largely developed in the tropics, though it is found in many temperate regions also. The genus *Solanum*, containing roughly twelve hundred species, is one of the largest known, and includes small trees, shrubs, climbing-plants, and herbs. It is most plentiful in South America.

Black nightshade is an annual, with a bushy branching habit that gives it the appearance of a small shrub. It is, moreover, often woody at the base. In the open it is 1 ft. or so high and more or less rounded and compact. A certain amount of shade does not kill it, though it changes its appearance so much that it is then often hard to recognize as the same plant.

The leaves are placed singly on the stem or in clusters, and a very common shape is that shown in the figure, though forms occur often enough in which they are strongly toothed or even lobed. They are thin in texture with well-marked veins, but this character varies very



BLACK NIGHTSHADE, NATURAL SIZE.

[Drawing by Esmond Atkinson.]

much according to where the plant is growing. In the shade the leaves and stems are pale green, but in the open quite often strongly tinged with blackish-purple.

The stems are angular in section and generally roughened at the angles. The figure shows the shape and arrangement of the flowers and fruit. The flowers are white with a cluster of five yellow anthers round the style and stigma, while the fruit becomes, when ripe, jet black, shining, and juicy.

POSITION AS A WEED.

Black nightshade is often spoken of as one of the most widely distributed plants in the world, and is found in nearly all subtropical and temperate countries in both hemispheres. In New Zealand it occurs in abundance as far south as Central Otago, from sea-level to 2,000 ft., and is, moreover, spreading in some districts. There is evidence that in this country there are two species which have been confused—the introduced weed and a little-known native plant. In an article in the "Natural History of Canterbury" that includes a list of native plants with the communities to which they belong, Dr. L. Cockayne, F.R.S., says: "Forest, but not in the primitive community (the New Zealand plant probably is an unnamed endemic species, and *S. nigrum* L. is an introduced species)." The differences between the two plants, however, are small and of a technical nature, and the one that concerns readers of the *Journal* is the black nightshade, which is a weed of gardens, roadsides, and waste places generally, and—more recently—in some districts, of thin pastures (Hilgendorf, "Weeds of New Zealand," page 152).

The following passage in Mr. E. Bruce Levy's "Grasslands of New Zealand," page 101 (though black nightshade is only one among a number of weeds there mentioned) is quoted here in full, as the information it contains is very much to the point in dealing with the present plant and others closely related as weeds: "Most of our weeds of arable land are annuals which establish in the early warm weather of spring. Many such annuals—namely, summer annuals—establish only in the spring, and among the more common ones may be mentioned fat-hen, smartweed, wireweed, black nightshade, purslane, bindweed, &c. If the pasture mixture be spring-sown on land infested with seed of these weeds they become powerful competitors, whereas if the pasture is autumn-sown there is no danger from them whatever. If these weeds germinate at all in the autumn they never become well-established vigorous plants."

Black nightshade is fairly often spoken of as a poisonous plant—though the evidence is conflicting, as jam has been made of the berries—and the name "deadly nightshade" has been given to it. The true deadly nightshade (*Atropa belladonna* L.), which is quite a different plant, belonging to the same family as black nightshade but not closely related to it, is extremely poisonous, and contains the alkaloid atropin, which is used in medicine. A few scattered plants of *Atropa belladonna* have been found naturalized in New Zealand, but fortunately it does not seem to have spread. Those who think that popular plant-names are accurate enough for the practical man have here an example of their not proving altogether adequate.

PHOSPHATE TOP-DRESSING OF HILL GRASSLAND.

MANAWATU FARMER'S RECORDED RESULTS.

Fields Division.

THE trial described in these notes was commenced in the winter of 1928 on the property of Mr. A. K. Greves, Aokautere, near Palmerston North, in co-operation with the Department of Agriculture. The farm is situated at an elevation of approximately 1,200 ft. to 1,500 ft. above sea-level. Its total area is 400 acres, of which 350 were used in the trial. The remainder consists of bush and two small paddocks under cultivation.

The pastures prior to top-dressing consisted of cocksfoot, crested dogstail, and a little rye-grass and white clover, together with a good deal of catsear and rib-grass. An area of 150 acres was top-dressed with about 3 cwt. of superphosphate per acre during July. Of this area a paddock of 79 acres had been top-dressed in the winter of 1925, but so far as could be observed the effect of the manure in 1928 was negligible. An area of 200 acres was used as a control for the trial.

It was impossible to predetermine the exact relative carrying-capacities of the two areas, so each was stocked with ewes plus a few dry sheep, at what was considered to be their probable respective capacities, the top-dressed area at the rate of 2 sheep and the control area at 1½ sheep per acre. The use of cattle on this country is highly advantageous, and beasts were grazed on both areas as shown in the tabulated statement. The cattle-grazing commenced on 15th September, and on the 31st March, 1929, the cattle were still on the top-dressed area.

A marked stimulation of white clover occurred as a result of the top-dressing, and the growth of rye-grass was noticeably improved.

All sheep were shorn by Mr. Greves, who reported as follows: "The ewes from the top-dressed area were in good condition and shored easily, with only an occasional gummy fleece. The ewes from the non-top-dressed area were not in such good condition, and on an average their fleeces were very gummy." The wool from each lot was kept separate and valued by a disinterested person who knew nothing of the history of the trial. He remarked regarding the wool from the sheep off the top-dressed area that it was "Brighter, better grown, and with very few cotts"; whereas he described the wool from the non-top-dressed area as "harsher feeling, with more cotted fleeces, and not such a good colour." The weights of wool produced and prices realized were as follows: From top-dressed area, average 8 lb. per fleece, and 16d. per pound realized; from non-top-dressed area, 7.8 lb. fleece, and 15½d. per pound realized.

Referring to the shearing of the lambs, Mr. Greves states that in the case of those from the top-dressed area the comb of the shearing-machine required cleaning after every eight or nine lambs, whereas it had to be scraped after every three or four lambs when shearing those from the non-top-dressed area.

Statement of Accounts: A. K. Greves, Aokautere.

Top-dressed Area, 150 Acres. Stocked at 2 Ewes per Acre.										Non-top-dressed Area, 200 Acres. Stocked at 1½ Ewes per Acre.									
Date.	Revenue Items.	Number.	Receipts.			Date.	Revenue Items.	Number.	Receipts.										
			Rate.	Weeks.	£ s. d.				Rate.	Weeks.	£ s. d.								
Jan. 4	Fat lambs	..	47	..	53 15 7	Jan. 2	Fat lambs	..	26	..	28 10 2								
Jan. 26	"	..	36	..	34 3 0	Jan. 14	Store lambs	..	100	17 6	87 10 0								
Jan. 25	Wool	..	..	..	130 11 9	Mar. 25	Wool	..	..	..	102 9 3		
Mar. 20	"	..	..	..	37 12 4	Mar. 20	"	..	..	..	31 4 2		
	Grazing—						Grazing—												
	Bullocks	..	59	1 6 4	17 14 0		Bullocks	..	35	1 6 4½	11 5 0								
	"	..	35	1 6 8	21 0 0		Cows and Heifers*	..	22	1 0 31	34 2 0								
Mar. 31	Cows and Heifers*	..	22	1 0 6½	6 18 3	Jan. 14	Ewe lambs to top-dressed area	69	23 0	..	79 7 0								
Mar. 31	Ewes on hand	..	111	27 0	149 17 0	Jan. 15	Wether lambs to top-dressed area	40	13 2	..	26 6 8								
Mar. 31	Wethers on hand..	..	92	20 0	92 0 0														
	Increased value of lambs transferred from non-top-dressed area—																		
	Ewes	..	69	4 0	13 16 0														
	Wethers	..	40	0 10	13 13 4														
	Less cost of top-dressing	..			571 1 3														
					144 6 0														
	Net total	..			426 15 3		Total	..			400 14 3								

* 17 heifers and 5 dry cows

The returns per acre from the top-dressed area amount to £2 16s 3½d on this basis, while from the non-top-dressed area they are £2 os. 0½d., giving a balance of 16s. 3d. per acre in favour of the top-dressed land.

Two small drafts of fat lambs (as shown in the table) were taken off the top-dressed area, and only one from the non-top-dressed area.

Mr. Greves's records of the cost of top-dressing are as follows:—

	£	s.	d.
22 tons super (44/46 per cent.) at £5 per ton	110	0	0
Cartage from rail to farm, 10s. per ton	11	0	0
Sowing—136 hours at 2s. per hour	13	12	0
Sledging—One man and two horses for 48½ hours, at 4s. per hour ..	9	14	0
	£144	6	0

Cost of manure and application per acre = 19s. 3d.

Cost of application of manure from roadside = 3s. 1½d.

Average number of acres top-dressed per man per eight-hour day = 8.8.

The accompanying table has been arranged from returns presented by Mr. Greves. The increase in value given to lambs transferred from the non-top-dressed to the top-dressed area for the period of ten weeks may not be fully justified. However, this does not make any appreciable difference to the increase in return. The effect from the top-dressing will continue for another year at least, even though in diminishing amount, so that the statement does not reveal the whole of the benefits derived from the fertilizer.

A further objective of this trial is to maintain the country already top-dressed, and each year bring a further portion under treatment, increasing the stock each year by holding sufficient ewe lambs for replacement and a reasonable increase as well.

The Division is indebted to Mr. Greves for the care taken with the management and records of the farm in connection with the trial.

Temporary Sterility of Dairy Cows—Dealing with sterility in an article published in the *North American Veterinarian* for May last, Nils Lagerof, a Swedish investigator who recently visited Denmark, Germany, Switzerland, and Holland, states that in those countries treatment is carried out according to the methods of Albrechten and Hess—methods with which we are quite familiar in New Zealand. In short, they consist of manipulation of the ovaries and a specialized method of irrigating the uterus. Both methods give excellent results in cases where there are well-defined disease conditions, but, unfortunately, do not appear to give equal results in the temporary form of sterility, which constitutes by far the greatest number of cases under investigation. Temporary sterility appears to be a functional sterility, and noticeable disease conditions of any importance are conspicuous by their absence. Following this line considerable investigational work is on hand in New Zealand with the use of calcium by various methods, mineral supplements, and the use of the fairly recently discovered vitamin E—work which should offer a far more promising field.—*Live-stock Division*.

Interim Returns of Live-stock.—Approximate figures for 1929 include the following (the final figures for 1928 being added in parentheses):—Horses, 299,120 (307,160); dairy cows, 1,370,779 (1,352,398); total cattle, including dairy cows, 3,444,191 (3,273,769); number of sheep shorn, 1928-29 season, 25,290,878 (23,958,577); number of lambs tailed, 1928-29 season, 13,853,087 (13,178,972); total sheep—including lambs, 29,011,447 (27,133,810); pigs, 556,795 (586,898). Details of the interim sheep return were published in last month's *Journal*.

MOULDS IN UNSALTED BUTTER.

RESEARCH AT WALLACEVILLE LABORATORY.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Division, Wallaceville Laboratory.

(Continued.)

FUSARIUM LACTIS.

Direct contamination by this mould in the butter-factory was hard to trace. There can be little doubt that its long rod-shaped spores are in circulation in the factory atmosphere, though only occasionally have they been isolated by factory-atmosphere exposures on artificial media. Growths of the mould are, however, to be found frequently on the woodwork of freezing-vats into which the cream is run after pasteurization. The typical red discoloration may be seen through the white paint on most of the older types of vat. This colour changes to purple or violet if there is a slight leakage of ammonia in the neighbourhood of its growth, or any percolation of ammoniacal fluid through the woodwork in these parts.

Spore-formation.—The spores of this mould are not nearly so numerous as in a number of others, and are produced in small bundles in scanty patches on the mycelium. The spores themselves grow in small bundles or singly at the end of very short hyphal cells. This head formation is very difficult to find under the microscope, as by the time any part of the mycelial growth has reached the slide for examination the spores have usually become detached. Moulds of this type are particularly difficult to stain, as in the presence of moisture there is a tendency to disintegrate into component cells. For staining purposes it is best to use glycerine with an alcoholic solution of carbol fuchsin. Examination of stained spores under the $\frac{1}{2}$ lens of the microscope shows the outer and inner cells of the spore quite clearly.

Mycelial Growth and Pigmentation.—The mycelium of this mould produces a close, much-branched growth in the butter in which it may be growing. Fine cross-sections of butter showing the typical red discoloration were cut after freezing on the microtome, and revealed the curious pigmentation produced by a mould of the *Fusarium* species. The cross-section revealed a very reticulated mass of mycelial hyphæ, which appeared to contain little pigment. At irregular intervals there were patches of deep red pigment apparently outside the body of the hyphæ. These patches of colour did not seem to have any connection with the formation of spores by the mould. Further cross-sections were cut and pressed on to the slide under a thin cover glass and then examined under the $\frac{1}{2}$ lens. The patches of pigment remained in irregular masses, some of which appeared quite detached from any mycelial cell. Photographs were subsequently taken of some of these patches of colour that had become partially dispersed, and would seem to indicate that a number of very fine rod-shaped organisms were present. After several washings of butter showing this red discoloration had been made with alcohol a



FIG. 6. CULTURE OF FUSARIUM LACTIS ON ARTIFICIAL MEDIUM.

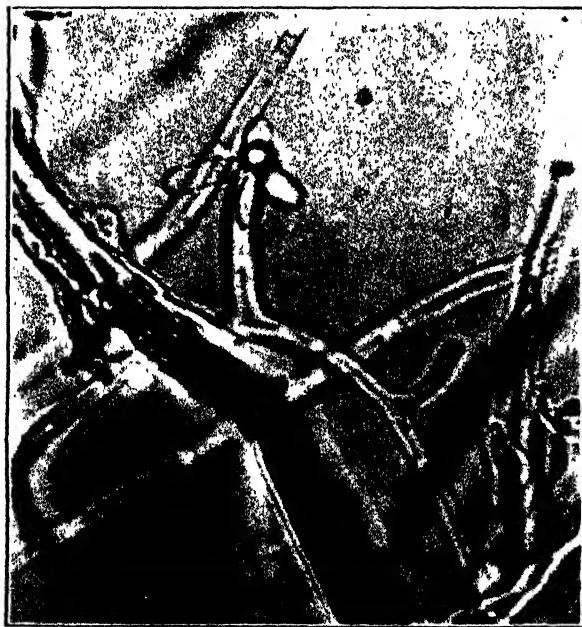


FIG. 7. PHOTOMICROGRAPH OF FUSARIUM MYCELIAL GROWTH AND SPORES OF FUSARIUM LACTIS. ($1\frac{1}{2}$ LENS.)

[Photos by G. F. V. Morgan]

large number of the small red masses were found in suspension in the alcohol, intact and separated from any other portion of the mould.

As distinct from the pigment produced by any of the other common butter-moulds, the pigment of the fusaria appears to be diffused through the body of the fat. It will be found that if the fat in discoloured portions of butter in which the fusaria are growing is extracted with ether or alcohol, the colour remains in the fat when it has been washed quite free from the mycelium of the mould. Pigmentation does not occur entirely outside the hyphal cells, for examination under the $\frac{1}{2}$ lens will show the presence of granules of colour in the body of the cells themselves, though these are not nearly so frequent or so large as the patches of red pigment lying outside. The red pigment produced by this mould is also capable of acting as an indicator for alkaline or acid conditions, as in the case of its presence under alkaline conditions the colour changes in a few seconds from red to violet or purple. This colour-change may frequently be noticed in old cultures of the mould, in butters in which large numbers of putrefactive bacteria producing alkali are present, or in which this mould, which produces an alkaline condition itself, is in an advanced stage of growth. Under these circumstances the colour produced by the mould is a deep purple or violet instead of red. This frequently occurs, and the presence of another type of mould is often suspected. Further investigation on the chemical composition of this pigment is being carried out.

The rate of mycelial growth in butter is very rapid, and this would cause a tendency to spread deeper into the texture of the butter than the other moulds; also a very luxuriant growth of aerial mycelia is usually produced, forming a white felted mass over the surface of the butter. This contains very little pigment, whereas the butter containing the lower portions of the mycelial growth may be a deep red. Artificial media in which this mould may be growing frequently show bright red spots in their substance before any appreciable growth of mycelium can be seen under the microscope; the same deep-red spots may be noticed as in butter. Spores are capable of germination on the outside of butter-paper and of growing through the texture of the paper into the butter.

The thermal death-point of fusaria is hard to determine, for the same reasons that apply to the other moulds. In the case of fusaria, however, no germination has been seen on any plate from cultures heated higher than 60° C.

Resistance to Brine Solutions.—The resistance of the spores of this mould to brine solutions is slightly greater than that of the *Stemphylium* type, in so far as they are capable of germination in media containing 8 per cent. solutions of salt, though no germination is obtained in over 7 per cent. brine in the case of the latter.

The spores of *Fusarium lactis* have been found to lose their vitality very quickly in water, no growth having been obtained from spores that had remained in water for more than three days.

Effects on Dairy-produce.—*Fusarium* moulds produce rapid alkalinity in the breakdown of protein matter, with the production of gas. Lactose is not fermented, but can be used in its metabolism. This mould can remain virile in butter for three months at cold-storage

temperature, but takes longer to germinate after defrosting than the *Stemphyllia*, *Penicillia*, and *Oidium lactis*, which are all capable of germinating ten days after defrosting. Moulds of the *Fusarium* type require frequently four to six weeks before they make their appearance.

Anaerobic Growth.—No cultures have yet been obtained from spores of this mould in butter or on artificial media under complete anaerobic conditions, incubated at 20° C.

PENICILLIUM GLAUCUM.

Contamination of cream and butters by the *Penicillium* type of mould is perhaps more common than by most of the other five moulds under review, and it may be considered as common a contamination as is that of *Oidium lactis* in dairy-produce. The spores of *Penicillium glaucum* are common everywhere, but in the butter-factories they appear to be found in and to prefer the drier parts of a factory building, such as the box-room and the rooms where salt and butter parchment are kept. It must be realized that no hard or fast line can be drawn for definite sources of contamination, as mould-spores of different varieties are to be found circulating in the atmosphere of the butter-room itself, which is perhaps the dampest place in any butter-factory. The spores of this mould very frequently settle on butter-parchment and remain virile under very dry conditions for a considerable time. This contamination of the paper in which butter is wrapped is a very frequent source of mould trouble in unsalted butters, and will be referred to later on. Though perhaps dry conditions may not be in any way considered as ideal for the growth of *Penicillia*, the spores certainly seem to remain virile under dry conditions longer than those of other moulds. Butter-box wood is also a frequent cause of contamination.

Spore-formation.—The spores of *Penicillia* are formed at the end of specialized erect hyphæ, which branch and form two parallel short hyphal cells, which in their turn branch again. At the end of these cells round spores are produced, which in the case of dense colonies may amount to seven or eight in number at the end of each terminal cell. When the conidiophore of *Penicillia* is growing horizontally over the surface of a liquid medium, as many as fifty spores have been counted on the terminal hyphæ. When the spores of moulds of the *Penicillium* type germinate the outer coat of the spore swells, but no abstriction occurs as in the budding process of yeast. The inner jacket of the spores swells and finally ruptures the outer jacket, from which the pro-mycelium projects; a double rupture of the outer spore frequently occurs with a double pro-mycelial growth. Mycelial growth in these cases takes place from both sides of the original spore. The spores of the *Penicillia* are round and smooth, and similar in shape to those of the *Aspergilli*. Young *Penicillium* spores may germinate in under twenty-four hours; spores of old cultures kept under dry conditions may take a week or even longer.

Mycelial Growth and Pigmentation.—The mycelial growth of *Penicillium glaucum* in butter seems less compact and more straggling than that of other butter-moulds. Its development seems to become concentrated about certain points; at these points a deeper pigmentation occurs, and if the butter is uncovered clusters of conidiophores will appear. This gives an impression of unequal colour-production, and



FIG. 8. PHOTOMICROGRAPH OF HEAD OF *PENICILLIUM GLAUCUM*, SHOWING SPORE FORMATION. ($\frac{1}{2}$ LENS.)

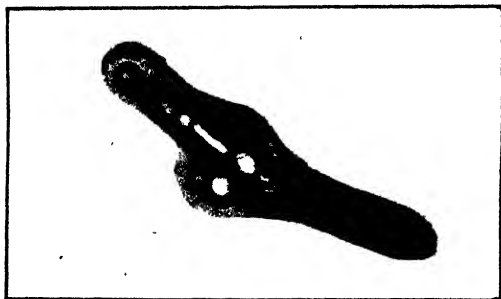


FIG. 9. PHOTOMICROGRAPH OF SPORE OF *PENICILLIUM GLAUCUM*. ($\frac{1}{2}$ LENS)

[Photos by G. F. V. Morgan.]

a more mottled appearance to butter discoloured by the mould. The colour produced in the tissue of the mycelium and conidiophores is a characteristic blue-green, which is particularly pronounced in the conidiophore of the mould. Pigmentation may be clearly seen in the older and coarser growths of the mycelium; the colour that is imparted to the butter, however, is a bright yellow, and not usually the blue-green of the mould pigment. The pigment of the *Penicillia* similar to that of the *Fusaria* seems to become disseminated through the body of the butter in the neighbourhood of the mould development, but this, unlike with the *Fusaria*, never seems to happen on artificial media. In the early stages of *Penicillium* growth in butter the bright-yellow discoloration only may be noticeable. This may also be the case in unsalted butter from the butter-box, where it has been closely covered and an aerial mycelium has not been able to appear. It is safe to suspect the

presence of *Penicillium* mould in any butter showing a yellow discoloration. Mycelial growth is in most cases much shallower than with other butter-moulds, and discoloration does not seem to penetrate very far into the body of the butter.

The *thermal death-point* of *Penicillium glaucum* seems, from an average of forty cultures, to be slightly higher than that of other butter-moulds. Spores have frequently germinated after reaching the temperature of 75° C. Cultures have also developed from spores that have reached 90° C., but these have been isolated cases.

Resistance to Brine Solutions and Disinfectants.—Spores of *Penicillium glaucum* can germinate in media containing 7 per cent. of salt. Germination in media containing 8 per cent. has rarely occurred.



FIG. 10. SHOWING GROWTH OF *PENICILLIUM GLAUCUM* ON SOLID MEDIUM

[Photo by G. F. V. Morgan.]

This mould will germinate after remaining in 5 per cent. formalin for ten minutes, but not in a higher percentage. Spores of *Penicillium glaucum* are capable of remaining virile in tap water for four months, and have been isolated from dry salt in which they must have remained virile for more than one month.

Biochemical Features and Effect on Dairy-produce.—*Penicillium glaucum* differs from all the other five common butter-moulds in the important fact that it produces acidity and no liquefaction of protein matter, whereas all the others produce an alkaline reaction with the breakdown of protein and the production of gas. *Penicillia* would appear to ferment lactose and so produce lactic acid. If colonies of this mould are grown on litmus lactose agar marked acidity will be noticed in the neighbourhood of their growth. *Penicillium glaucum* is also capable of growth and development in milk, and in litmus milk

will produce marked acidity and quick curd-formation. Growth on nutrient gelatine showed no liquefaction in two weeks. A distinct earthy flavour is produced in butter.

Anaerobic Growth.—Scanty growths of *Penicillium glaucum* have been obtained in eight days under complete anaerobic conditions on artificial media incubated at 20° C.

Behaviour under Cold-storage Conditions.—*Penicillium glaucum* will germinate in unsalted butter after remaining in store for three months at an average temperature of 5° C., but will not germinate in cold storage itself, only germinating when two weeks have elapsed after defrosting. Control samples germinated in one week at ice-box temperature—about 10° C.

OIDIUM LACTIS.

Contamination of dairy-produce by *Oidium lactis* is fairly general. Spores and fractions of mycelium are to be found in the cream, and may often be found in samples of milk shortly after it has left the cow. The spores are to be found in all parts of the factory, though growth on walls or woodwork is not frequently noticed. Spores are occasionally found on butter-parchment and in factory water-supplies.

Reproduction.—Spores of the type discussed in connection with the other moulds are not formed in the *Oidia*. Their reproduction is somewhat similar to that of mycelium-forming yeasts, the only apparent difference being that the *Oidia* are capable of forming dry aerial mycelium. No conidiophores are formed, but reproduction takes place by budding of specialized portions of the mycelium; branching also takes place in these parts. The budding parts referred to, when examined under the microscope, resemble the formation of chains of short hyphal cells. These cells break off and germinate in the same way as the ordinary mould-spore, forming a rudimentary pro-mycelium. The aerial mycelium forms a dense matted surface growth, white in colour, growing almost $\frac{1}{2}$ in. above the surface of the medium in which the mould is growing. In butter a comparatively short aerial mycelium is formed. To examine the reproductive parts of this mould staining with carbol fuchsin and glycerine will be found practicable, and an examination can be made under the oil immersion lens.

Mycelial Growth and Pigmentation.—The mycelial growth of this mould shows the development of long mycelial strands becoming intertwined in a rope formation, rather than the reticulated branching development characteristic of the other butter-moulds. The mycelia does not produce pigment either in its aerial growth or in the body of the medium in which it may be growing. In very old cultures of *Oidium lactis* in butter a brown discoloration may be noticed in the neighbourhood of its growth, but this seems to be due to the action of the mould and its by-products rather than a production of pigment by the mould itself.

Thermal Death-point.—This is less than that of the other moulds, few cultures germinating after treatment at a higher temperature than 55° C., and very few at or after 60° C.

Resistance to Brine Solutions.—*Oidium lactis* shows less power to germinate in a salt medium than any of the other moulds, no germination having been obtained in the presence of more than 4 per

cent. of salt. The resistance to salt itself seems to compare favourably with that of other moulds, as the spores of *Oidium lactis* are capable of remaining virile in fairly high salt solutions for three or four months, though the spores will not germinate in the butter itself or in a medium of equivalent saline strength.

Resistance to Disinfectants.—Results of culturing after treatment with formalin were uncertain, and nothing definite was obtained. Spores of this mould were capable of remaining virile in water for more than four months.

Biochemical Reactions.—*Oidium lactis* causes a breakdown of protein, with production of alkalinity and gas. This occurs rapidly in dairy-produce, and fairly rapidly in media containing a large percentage



FIG. 11. PHOTOMICROGRAPH SHOWING COMMENCEMENT OF BUDDING PORTION OF *OIDIDIUM LACTIS*. ($1\frac{1}{2}$ LENS)

[Photo by G. F. V. Morgan.]

of protein matter. Flavour produced is rather similar to that produced by certain dairy yeasts, and is typical of certain types of soft cheese, such as Pont l'Évêque, which are partially ripened by this type of mould.

Anaerobic Growth.—No growth has yet been obtained at Wallaceville under strictly anaerobic conditions, with incubation at 20° C.

Behaviour under Cold-storage Conditions.—*Oidium lactis* will not germinate in cold store at 5° C. in three months, but its spores will remain virile during that time, will germinate, and the mould will make its appearance in two weeks after defrosting. Mould will germinate in one week at ice-box temperature—about 10° C.

(To be concluded.)

METALS FOR DAIRY MACHINERY.

Report to the Dairy Research Management Committee by F. H. McDOWALL, D.Sc.,
Dairy Research Institute, Palmerston North.

THE problem of finding a satisfactory metal for use in the fabrication of dairy machinery has two aspects, which are often, but not always, complementary.

(a) *Milk should not have a deleterious effect on the metal.* It is desirable that dairy machinery should be made of a material that will not corrode or suffer other damage under any of the conditions of treatment to which it is subjected. It should not dissolve or stain in contact with milk, it should be sufficiently strong for its purpose, it should be a good conductor of heat, and it should be reasonably easily worked into the shapes required. So far as this aspect of the problem is concerned, the choice of material for any piece of equipment depends solely on economic circumstances. Replacements of corroded vats, coolers, buckets, and cans form a very considerable proportion of the annual expense of a dairyman or a dairy company, and much inconvenience can result if these replacements become necessary at the flush period of the dairying season. The progressive dairy company will choose the cheapest of the materials that give satisfaction, it being, of course, understood that the estimation is taken over a period of years covering the life of the machinery made of the metals under consideration.

(b) *The metals should have no effect on milk or its products.* In many phases of science the developments during the present century have been in the direction of discovering the effect exerted by small quantities of chemical substances. The effect of vitamins, in the science of nutrition, and the influence of small amounts of iodine in the soil in which foodstuffs are grown on the incidence of goitre, in the science of pathology, are well-known instances. Such developments have effected a notable change in the sciences, and have contributed largely to their progress. Of the discoveries made along these lines in the science of dairying, probably the most important is the effect of small quantities of dissolved metals on the quality of milk-products. It was shown by Golding and Teilman (Journ. Soc. Chem. Ind., 1905, 5, 24) that small amounts of copper can cause off-flavours in market milk. Rogers, Berg, Potteiger, and Davis (U.S. Dept. of Agr., B.A. I, Bull. 162, 1913) showed that fishy and tallowy flavours in butter can arise through the presence of minute amounts of copper. These findings have since been confirmed by many workers, and recently by Davies (*Industrial Chemist*, 1928, 269), who claims that as small a proportion of copper as one part per million in butter can cause fishiness and tallowiness. While such is probably not the case for all conditions of manufacture of the butter, it is a fact of very great importance to the dairy industry. It has been shown, too, that rusty cans are often responsible for a metallic flavour in butter, and in milk for marketing purposes; and Mattick has recently demonstrated that oiliness in milk can result from the use of a cooler of tinned copper from which the tinning had been partly worn away. The effect of small quantities of metallic salts in dairy-products has a special significance for the dairy industry in New Zealand, since the faults engendered by their presence are for the most part evident only after storage for some time.

The present report embodies the result of observations and inquiries made during a recent visit to dairies and dairying institutions in Europe and in the United States of America. Some of the metals are now under test at the Dairy Research Institute, but this report should be regarded,

for the most part, as the conclusions of the author drawn from the publications available on the subject and from the information gathered in the countries visited. Unfortunately the information obtained in different places was often quite contradictory. In Chicago, for example, a company engaged solely in the manufacture of nickel machinery offered the opinion that the metal was quite unsuitable for dairy equipment. They had formed this opinion after several tests under practical conditions in dairy factories. In the same city a visit was paid to a large dairy where the equipment was almost completely of nickel, which, though not perfectly satisfactory, was claimed to be better than tinned copper.

Hunziker (World's Dairy Congress, 1923 and 1928) and Seligman (World's Dairy Congress, 1923) have reported in detail on the problem. Further publications may be expected later from Germany, where an exhaustive investigation is being made, and from several institutions in America. While laboratory tests are essential before a metal is tried out in a dairy factory, it is obvious that a final conclusion as to the suitability for dairy equipment can only be reached after an extended test under factory conditions. The fabrication of a large sheet of metal free from irregularities, and from inclusions of slag and other impurities, is a more difficult task than the preparation of a uniform laboratory test piece. The reheating of the metal along the edges of the sheets for the purpose of making a welded join may introduce changes and irregularities not encountered in a straight laboratory test. Furthermore, it is difficult to simulate in the laboratory the actual conditions which a metal has to withstand in dairy practice. An endeavour was therefore made to obtain information from factories where the various metals had been tried out on the commercial scale, and from the manufacturers of dairy equipment.

Copper.

From the point of view of ease of fabrication, smoothness of surface, mechanical strength, and even, in many cases, durability, copper is a very suitable metal for dairy equipment, and in former years it was quite widely used in the industry. Supplee and Bellis (Journ. Dairy Sci., 1922, 5, 455), and Rice and Miscal (*ibid.*, 1923) have shown, however, that copper is dissolved in appreciable quantities even by fresh milk. These and similar laboratory tests, and difficulties in practice have led largely to the elimination in dairies of bare copper surfaces in places where they can come in contact with milk. This elimination is, however, by no means complete. The copper pipe was still being used in many dairies, in every country visited, for transference of milk from one holder to another. The copper evaporating-pan for condensing milk has not been superseded in any country, although for this purpose, in the future, nickel may prove a suitable substitute. It is especially interesting to note that Emmenthaler cheese (described in America simply as "Swiss" cheese) is invariably made in a copper kettle. In Switzerland, France, Germany, Denmark, Sweden, and the United States of America such kettles were seen in use. Emmenthaler cheese is made night and morning from perfectly fresh milk; the cooking-temperature is about 130° F., and the milk or whey is in contact with copper for about two hours before draining. After removal of the whey the vessels are immediately cleaned, and well scoured with sand to a bright polish. The author was informed that only cheeses of the non-acid type, such as Emmenthaler and Gruyère, can be made in the copper kettles. Samples of cheese made in such kettles were collected in southern Germany and in Switzerland, and analysed for copper, with the following results:—

			Parts Copper per Million.
Emmenthaler from South Germany	..	..	6
Emmenthaler from Switzerland	..	..	18
Petit Gruyère from Switzerland	..	..	9

Dr. Koestler, of the Swiss Dairy Experiment Station, supplied the following analyses of three cheeses made in Switzerland :—

			Parts Copper per Million.
1	Cheese from a Swiss farm dairy .. ..	..	40.0
2.	Emmenthaler cheese .. ..	..	2.4
3.	Cheese from Experimental Dairy, Liebefeld ..	..	4.0

Cheese No. 1 had been turned green by the excessive amount of copper which it contained, while cheeses Nos. 2 and 3 were of first-class quality, as were also those analysed by the author, one of which was twelve months old. When these figures are compared with the results of Davies, which show that butter can be rendered inedible in six weeks by the presence of one to five parts of copper per million, it becomes obvious that the catalytic action of copper in causing deterioration of dairy-products is governed, in some way not yet accurately defined, by the chemical and physical conditions existing in the product. The tentative conclusion may be drawn that copper is more active in an acid than in an alkaline medium.

In New Zealand dairy practice there is no opportunity for cheese-milk to take up appreciable amounts of copper; but in many butter-factories there are in use coolers and holding-tanks for cream from which the tinned coating has been worn. Such equipment is a source of great danger. A sample of whey butter made in a Southland factory from cream which had been run over a cooler with much bare copper showing had a copper content of four parts per million. In England a sample of bleached New Zealand whey butter with a strong tallowy odour, submitted to the author by the Inspector of Dairy-produce, was shown to contain six parts per million of copper, which in the course of transshipment to England had rendered the butter quite unfit for human consumption.

It seems, therefore, that, except for Emmenthaler-cheese kettles, sheet copper will be gradually eliminated and replaced by other more suitable materials for use in dairy equipment.

Tinned Copper, Brass, Iron, and Steel.

Despite their disadvantages, which are no doubt sufficiently familiar to dairymen in New Zealand, these materials have not been superseded in any country for general dairy-work. The tinned-copper cooler, pasteurizer, and holding-vat, and the tinned-steel cheese-vat are still accepted equipment in dairy factories alike in Holland, Denmark, Sweden, and the United States of America. Copper is a good conductor of heat, and is easily worked into the shapes required, and steel and iron are relatively inexpensive. Moreover, fairly satisfactory results have been obtained from such equipment, and the dairy-owner or dairy company is reluctant to risk the uncertainty of a new material.

The fact remains, however, that the tin coating on copper or steel is not entirely satisfactory. When the sheet of iron and copper is smooth, and the tin coating has been well applied, it acts as a good protective agent, preventing copper from going into solution. Tin is, however, quite appreciably soluble in fresh milk and in lactic acid (Hunziker, World's Dairy Congress, 1928; Martell and Lincoln, Chem. & Met. Eng., 1926, 33, 622). It is not immune from the action of strongly alkaline solutions used for cleansing purposes, and, as it is very soft, it is easily removed by mechanical wear.

It is true that preparations such as "Soldo"* and "Bestin"* are now available for retinning corroded and worn surfaces *in situ*; but it is also true that in factories in all the countries visited, as also in New Zealand, one could observe worn surfaces where the base metal was open to contact with the dairy-product. Recent tests in some butter-factories near

* The value of these preparations is now being tested out at the Institute here.

Palmerston North have shown that there is a distinct rise in the copper content of cream held overnight in vats showing only a small surface of bare copper. There is always a lag period between the time when a recoating is necessary and the time when the company agrees to submit to the necessary expenditure. During this period the dairy-product may suffer in quality. For these reasons, and because of the actual expenses of repair, the feeling is abroad among those interested that a material which gives a certain measure of satisfaction is not good enough, and much attention is being devoted to the problem of finding a substitute.

Aluminium.

From many points of view aluminium is a very suitable metal for dairy equipment. It is relatively not expensive, and it is not difficult to fabricate. It is quite distinctly soluble in milk; but aluminium salts are almost tasteless, and they have no effect on the flavour and keeping-quality of milk and other dairy-products, unless these have a very high acidity (*e.g.*, acidophilus milk, used in Europe and America as a beverage and for medicinal purposes).

For dairy-factory equipment aluminium has found its most extended use in Great Britain, largely owing to the activities of a London company, which has carried out a great deal of research on the methods of treatment and working of the metal. A city dairy recently constructed in Edinburgh has installed aluminium equipment wherever possible. A cheese-vat in aluminium at the Danish Dairy Experimental Station at Hillerød was giving satisfaction; but a member of the Swiss Dairy Experiment Station at Liebefeld, Bern, said that they had found aluminium an unsatisfactory substitute for copper in the Emmenthaler-cheese kettles. The curd had been found to adhere to the metal, and when separated by cutting it broke into small pieces unsuitable for the manufacture of Emmenthaler cheese. Apart from this effect, they found no noticeable difference in the cheeses from the two kettles.

The chief use of aluminium observed in dairies in other countries was for the construction of large holding vats and tanks for milk. A wagon used by a London city dairy for transporting milk in bulk from the collecting-station at Frome to London came under notice. The cylindrical tank is divided into three sections, each of which contains an aluminium holding-vessel. The wagon itself has a weight of 8 tons 4 cwt., and, when fully loaded, of 20 tons 4 cwt., representing a capacity of 2,620 gallons of milk. Aluminium is specially suitable for such a purpose on account of its lightness. The claim is made that the use of aluminium tanks in this wagon gave an extra capacity of 500 gallons of milk for the same total load.

Aluminium equipment for dealing with heated milk requires special care in manufacture, since the higher temperature enhances the effect of impurities in causing pitting of the surface. In a number of city dairies in England large aluminium vats are in use for pasteurization of milk by holding it at 145° F. for thirty minutes. After three years' service they showed no signs of deterioration.

Aluminium is not regarded as a suitable metal for whey-storage tanks.

A decided disadvantage of aluminium for use in dairy equipment is its softness and lack of strength. Its lightness would make it an ideal material for milk-cans, if this quality were not counterbalanced by the necessity of using thicker plate in order to obtain the requisite strength. Even under these conditions the bottom rim has to be made of steel, to give strength, and especially hardness, where it is most needed. The aluminium cheese-vat seen at the Danish Experiment Station had suffered considerable damage from mechanical abrasion. That a number of aluminium alloys of the requisite strength are available is obvious from their rapidly extending

use in automobile and aeroplane engine construction. The author has no information as to whether these are sufficiently inexpensive for use in dairy equipment, and whether they would withstand the action of milk and its products. Hunziker (*loc. cit.*, 1928) describes an alloy of manganese and aluminium which is resistant to the action of milk, but he gives no information as to its relative strength. Tests are now being made in the United States of America on milk-cans of an aluminium alloy which, it is claimed, has a strength comparable with that of steel. Seligman (*loc. cit.*) expresses the view "that none of the alloys of aluminium offer any hope of proving suitable for dairy purposes."

The purity of aluminium used in the manufacture of dairy machinery is a very important factor. The metal is especially susceptible to electrolytic action when in contact with another metal, and the presence of local impurities in an aluminium sheet causes serious pitting of the surface. It is well known also that cast aluminium is much less resistant to corroding agents than wrought aluminium, probably due to the entrance of impurities during the casting, as well as to the difference in physical condition. Impure aluminium has a marked tendency to stain at the surface of the liquid, where it comes in contact with air and liquid. Even the purest aluminium is not always free from this defect. It is especially advisable to wash aluminium equipment immediately after use, since the greatest damage occurs generally when the metal, contaminated with a film of milk solids, is left exposed to the atmosphere.

Probably the greatest disadvantage of aluminium for dairy equipment is its instability to the usual alkaline agents, caustic soda and alkaline carbonates, in which it rapidly dissolves. Addition to sodium carbonate of sodium silicate (ordinary water-glass) in the proportion of 1 part silicate to 2,000 parts of carbonate has the effect of completely retarding its corrosive action; and preparations, such as "Carbosil," are now available which contain the necessary protective agent. (It should be noted that sodium silicate does not exert its protective action with caustic alkali washing-powders.) It would appear, therefore, to the ordinary observer, as it appears also to the chemist, that the difficulty had been overcome; but whereas the scientist deals only with facts, the factory-manager must reckon with the human element. The author was repeatedly informed by technical chemists and factory-managers that they had found it impossible to induce the workmen to treat aluminium equipment with respect, by using only the special detergent for cleansing purposes. The secretary of a large Dutch co-operative organization for designing of dairy factories and for erection of dairy equipment stressed the inadvisability of installing into a factory any equipment requiring care on the part of the workmen, particularly if this is different from the other equipment in the factory. Similar reports were heard in America; and quite recently, in South Auckland, the information was received from the manager of a large dairy factory using aluminium holding-vats that it had been found necessary to forbid the use of any detergents whatever on the vats, as it was their experience that the workmen could not be trusted to use only the special cleansing-powder. While admitting the difficulty, the author does not regard it as an insuperable one. It should not deter a dairy company from purchasing in aluminium the equipment for which the metal is especially suited—viz., large holding vats and tanks for sweet milk and cream at ordinary temperatures.

The complaint was frequently heard that aluminium equipment cannot be repaired once it has become defective. Later information, however, indicates that such is not the case, although the operation requires a certain amount of skill. It is somewhat difficult to work the repaired portion to a smooth finish, and the strength of the sheet around the heated portion may be lessened through annealing during the process.

Nickel.

Nickel is more readily soluble than tin in milk and milk-products, more especially in milk with a high acidity. Hunziker, Grindrod, and Quam have, however, severally shown that the metal has no appreciable effect on the flavour and quality of sweet milk. Hunziker (*loc. cit.*, 1928) found under experimental conditions with nickel in the laboratory that a "slightly metallic and bitter flavour" was produced with "highly acid acidophilus milk, with starter, and with sweet cream, hot and cold." These effects were not noticed in actual practice with an all-nickel horizontal-coil vat installed in one of the factories of the Blue Valley Creamery Co. of Chicago. The vat was used for pasteurization, steam being passed through a horizontal coil which revolved in the cream, stirring it at the same time. Brine was then passed through the coil till the cream had been cooled sufficiently, and ripening was allowed to take place during twenty-four hours. Hunziker reports, "The vat has been in daily use for a period of over two years, and at no time has there been any indication of metallic flavour in the milk-product, although the nickel has lost its original lustre, shows considerable tarnish, and analysis of the cream by Quam disclosed the presence of appreciable quantities of dissolved nickel." It is open to question whether such favourable results would be obtained under New Zealand conditions, where the long delay between manufacture and consumption allows a full opportunity for metallic contaminations to exert their effect, although the evidence available indicates that nickel is a much less active catalytic agent than copper. A nickel cooler is at present under trial at the Massey College dairy factory.

The use of nickel in dairy equipment has hitherto been limited by its expense and by difficulties of fabrication. Both these difficulties are being overcome, and the metal is at the present time being used quite extensively for dairy purposes, especially in America. A large city dairy in Chicago has recently been fitted out with all-nickel equipment, including coolers of nickel. The only difficulty so far encountered is the tendency of nickel to tarnish in contact with milk. (Compare the results of Hunziker quoted above.) The manager of the dairy has been unable to find a cleansing agent that will effectively remove the tarnish, and it has been found necessary to polish the metal by hand once every week, a task involving quite a considerable expense.

Nickel is often used in the United States for the manufacture of heating-coils in coil vats the container of which is made of stainless steel, nickel being much more easily worked into coil form than stainless steel.

Grindrod has found nickel the most suitable metal for the fabrication of his patent sterilizing equipment for milk and cream, in which the temperature rises to 230° F. His company is now able to supply in nickel both the sterilizing equipment and the vacuum-pans for condensing purposes.

Nickel as a coating on other metals is not a satisfactory protective agent. Nickelled copper, for example, rapidly stams in black spots in contact with milk. Actually, since nickel is more soluble in milk than tin, no advantage over tinned copper could be expected from equipment of nickelled copper.

In some places difficulties had been encountered in the soldering of nickel, owing to differences in the coefficients of expansion. The difficulties were especially marked on a twist join.

Copper-nickel Alloys.

Of late years some alloys of copper with other metals, chiefly nickel, have been widely advertised for use in dairy factories. The most important of these alloys are monel metal and silveroid, both of which have

a bright silvery lustre. Hunziker's experiments show that they are not attacked so easily as copper by milk and its products, and that their effect on the milk-product is not so noticeable, although often quite distinct. It is Hunziker's opinion that "neither of the alloys give dependable protection against metallic injury to the flavour of milk-products."

In the countries visited the alloys were being used chiefly for milk pipes and connections, on account of the relative ease of fabrication. They are more suitable for this purpose than for vats, where the milk or cream is in contact with the metal for some time. They were not seen very much in use in cheese and butter factories. Silveroid appears to be of no use as a material for starter cans.

Silicon Irons.

In recent years, a number of high-silicon irons have been used successfully for acid-resistant equipment in the chemical industries. Their use for dairy equipment is, however, greatly restricted, owing to the fact that they cannot be *worked* into shape. Like cast iron, they are very brittle, and cannot be forged or rolled.

Stainless Iron and Steels, and Chromium-nickel Steels.

The so-called stainless steels are a development of the last fifteen years, since Brearley, in 1913, working in the joint research laboratory of Messrs. John Brown and Sons and Messrs. Thomas Firth and Sons, Ltd., of Sheffield, noticed that steels containing much chromium were not etched by the usual reagents. In 1914 stainless steel first became available to the public in the form of table cutlery.

It is important to note that the chromium steels are a class, not an individual alloy, and that the properties of the alloy vary with the carbon content, the chromium content, and the heat treatment it has received. Just as all grades of material can be obtained, varying from soft iron to a hard tool steel, by varying the proportion of carbon from nil to about 1.5 per cent., so similar grades of stainless iron and steel can be obtained by varying the carbon content from less than 0.10 per cent. in stainless iron to 0.70 per cent. in a stainless steel. A further variable has, however, been introduced—viz., the chromium—the proportion of which has a marked effect on the properties of the resulting steel. When an ordinary steel of the correct composition has been chosen for a specific purpose, it must receive specific treatment in order to produce the correct physical condition in the steel. In the making of razor-blades, for example, steel requires a special treatment. These facts are known to the layman as well as to the metallurgist. It is not so fully realized, however, that the "stainless" steels are available in a similar variety of grades, and that they require equally careful treatment. These details are included in order to stress the fact that it is as necessary carefully to choose a suitable grade of stainless steel for any particular purpose as it is to choose a grade of ordinary steel for its particular purpose.

There is a very important difference in properties between ordinary steel and stainless steel, the difference becoming more distinct with increasing content of chromium in the stainless steel. When ordinary steel is heated to a temperature above the carbon-change point—750°–800° C.—and is allowed to cool in the air, it is softened. In order to obtain a hard steel the hot article must be quenched—i.e., rapidly cooled in water or in oil—according to the grade of hardness required. Stainless steels, on the other hand, have the property of hardening to a greater or less degree according to the composition, when allowed to cool in the air. Apart from the mechanical and physical properties, with which this paper is not so much concerned, such hardening has an effect on the corrosion-resisting

properties of the steel. It will be realized that with a large sheet of steel it is scarcely possible to get a uniform rate of cooling, unless a special furnace is used in which the rate of cooling can be controlled. It is thus easily possible that a sheet of stainless steel, unless it is very carefully made, may have different properties at different points on the sheet. It will also be sufficiently clear that a successful laboratory trial with a small test piece of steel in a corrosive liquid is not sufficient to justify the expectation that equal success will immediately be achieved with a large sheet in the same liquid.

The replies received by the author to his inquiries from dairymen in other lands as to their experience of the suitability of stainless steels for dairy purposes were very much at variance. When due consideration is given to the nature of materials and to their novelty, this was perhaps to be expected. A successful trial on the large scale is of much more importance than a number of failures, since it indicates that a uniform measure of success will ultimately be obtained, when more experience is gained in the manufacture and fabrication of the alloys.

In England and on the Continent of Europe dairy-machinery manufacturers were only beginning to realize the possible advantages of stainless steel for dairy equipment. In America there has been a great deal of research on the question, both by individual workers and by the staffs of dairy-machinery manufacturers. The results obtained by the individual firms have not been made public, but they are embodied in Hunziker's last report to the World's Dairy Congress. The two grades of stainless steel therein considered viz., "Enduro" and "Ascoloy" were found to be stable, in the form of small test pieces, to milk and its products under most conditions, and to washing-powders, disinfectants, and brines. They were attacked to some extent by the highly acid acidophilus milk.

The author has seen a number of cheese-vats and milk- and cream-holding vats made of these materials in dairy factories in the United States of America. In most cases the junction was affected by means of solder (stainless-steel sheets can be readily joined in this way, although the low heat-conductivity renders the operation perhaps a little slower). In some cases the vats were giving satisfaction, while in other cases rusting was evident at the junction and on other portions of the surface. The experience of one large dairy-machinery manufacturing firm may be worthy of quotation: As a result of successful trials with small test pieces in the laboratory, a large contract was taken to install stainless-steel holding-vats into a city milk-station. Within a year they had rusted so extensively that the firm was compelled to replace them by similar vessels of tinned copper.

It is the author's opinion that the above grades of stainless steel cannot be regarded as suitable substitutes for tinned copper in ordinary dairy practice.

Chromium-nickel Steels.

While the anti-corrosive properties of chromium-nickel steels were known before the actual development of stainless steel, they have not been used to any considerable extent until within recent years. They are now manufactured in England under the names of "Staybrite" and "Anka," in Germany as Krupp's "V.2.A.," and in the United States of America as "Allegheny metal."

As a result of his laboratory tests, Hunziker regards Allegheny metal (formerly called "Superascoloy") as the most suitable material for dairy purposes, on account of its almost complete resistance to the corroding action of milk and its products. These conclusions have been borne out in practice, and they would no doubt hold for the other three brands of chromium steels named above.

A Staybrite starter-can in use in a large cheese-factory in England was giving satisfaction, and the metal had not lost its polish after six months' use. Staybrite is being widely used in England in the brewing and allied industries, and, if it can be produced sufficiently cheaply, will probably be used on a large scale by the dairying interests.

In the United States Allegheny metal has been found to give satisfaction in dairy factories, both on account of its resistance to corrosion, and the absence of any deleterious effect on the milk. One large firm of ice-cream manufacturers has used a 1,000-gallon vertical holding-vat of Allegheny metal for two years without experiencing any trouble. They have found glass-lined equipment to be unsuitable because of its liability to mechanical breakage, and are now replacing it by similar equipment in Allegheny metal.

Allegheny metal has also been used to a considerable extent for coil vats for holding cream. In this case the coils are made of nickel, since it is not yet possible to fabricate Allegheny metal in the coil form. Such vats are giving good service, and have the advantage over all-nickel equipment that they do not require polishing.

The chromium-nickel steels are not so sensitive to electrolytic effects as ordinary stainless steels, and they can be joined more easily without suffering such serious alterations in their powers of resistance to corrosion. The material can be soldered, or joined by pressing, solder being used as a filling agent; or the join can be made by welding, with subsequent grinding-off to a smooth surface. The last is undoubtedly the most satisfactory junction.

In the manufacture of dairy equipment from chromium-nickel steels some difficulty has been encountered, since the alloys become harder with cold working. In the making of a form requiring extensive cold working it is necessary to reheat several times in order to keep the material in a workable condition. Furthermore, this hardening is accompanied by a lowering of the resistance to corrosion. Hence it is essential that the worked product should be finally reheated to 1100°-1200° C., and allowed to cool either in air or water. Some forms of equipment required in dairy factories are not yet available in chromium-nickel steels. The makers of Allegheny metal, for example, cannot supply milk-tubing with a polished internal surface. One large continental dairy-machinery manufacturer is now supplying milk-cans, buckets, strainers, and coolers in Staybrite steel. The cost of dairy equipment in chromium-nickel steels is considerably greater than that of similar equipment in tinned copper, both on account of high original costs of material and of high working-costs. It is, however, not so expensive as nickel. Although the author has no quotations for dairy appliances as used in New Zealand dairy factories, the following scale of comparative costs would probably apply:—

- (1) 300-gallon coil pasteurizer-vat: All tinned copper, cost £140; with pure-nickel lining, coil, and cover, £115 extra; with pure-nickel coil, Allegheny-metal cover and lining, £100 extra.
- (2) 100-gallon starter-can: Tinned copper, cost £45; with Allegheny-metal lining, £6 extra.

A quotation was obtained in England for welded whey-tanks in Staybrite steel of capacities 1,500 and 3,000 gallons, the respective prices being £140 and £180 — *i.e.*, less than half the price of glass-lined equipment of the same size.

Glass-lined Equipment.

Attempts have been made within recent years to eliminate the difficulties due to the interaction of milk and metals by the use of a neutral glass-like coating on steel vessels. Such equipment has for the most part taken the form of large holding tanks for milk or cream. They have been

made with a jacket for steam or brine, but these have proved unsatisfactory on account of the corrosive action of the brine on the steel. The unjacketed glass-lined tanks and vats have been found to give complete satisfaction so long as the enamel remains intact. With careful treatment they give good service; but they very easily suffer mechanical damage, especially through the accidental dropping of a spanner, or through the rubbing of milk-cans. The most important objection to the use of glass-lined equipment is that it cannot be repaired. When the enamel has broken from its steel foundation in one place, replacement becomes necessary.

Glass-lined vats are being used in England, on the Continent of Europe, and in America for large lorry and railway tank wagons for the transport of milk for city milk-supplies. They do not, however, appear to possess any advantages over the lighter and much cheaper aluminium tank wagons being employed by one large London dairy.

When great durability is required, it seems that chromium-nickel steels of the Staybrite type will eventually replace glass-lined equipment for most purposes.

Summary.

In all the countries visited tinned copper was the most widely used material for dairy equipment. It has, however, the well-known disadvantage that the tin coating becomes worn away, leaving a bare copper surface open to contact with the milk or cream, with resulting possible deterioration of the dairy-product.

Copper alloys, such as monel metal and silveroid, cannot be regarded as desirable substitutes for tinned copper, although they are often useful for traps and junctions.

Aluminium is especially suitable for large holding-vats for milk or cream, and for milk-tubing, but satisfactory results will only be obtained if the metal is free from impurities. It is more resistant to corrosion in the worked form than in castings. Its softness renders it unsuitable for cheese-vats or for milk cans. Experiments are being carried out in the United States of America on an alloy of aluminium and manganese, which has the requisite strength for milk-cans. Aluminium equipment must not be cleaned with caustic soda or ordinary washing-soda, in both of which it dissolves freely. A safe cleansing agent can be made by the addition of ordinary water-glass to the washing-soda solution.

Nickel is proving a useful metal for dairy equipment. It is dissolved to some extent by milk, but it produces no serious effects on the flavours. It has the disadvantage that it loses its bright lustre after a time.

Ordinary stainless steels have in some cases given satisfaction, but experience has been so variable, owing to the effect of slight differences in the mode of fabrication, that they cannot be recommended as reliable materials for dairy equipment.

The chromium-nickel steels are almost completely resistant to the action of milk and its products, and have given satisfaction in a number of large dairies in America. It seems probable that these materials will ultimately replace tinned copper or enamelled steel for many types of dairy equipment.

Aphis on Pear-tree Roots.—The Orchard Instructor at Nelson reports: "An instance of the dying of pear-trees from an attack of aphis on the roots came under my notice during March last. The foliage turned a purply-brown colour and fell off, and an examination of the roots disclosed the presence of aphis on the roots. The case was brought under the notice of Dr. Miller, of the Cawthron Institute, and experiments are to be undertaken for combatting the trouble.

CLEARING GORSE WITH THE DRAINING-SPADE.

A METHOD of hand-clearing big gorse, recently brought to my notice at Ohacawai, is worthy of mention as being a considerable improvement on the mattock. The gorse is taken out by means of an ordinary 18 in. draining-spade, and the men using the implement assert that big clumps which would take from fifteen to twenty minutes or longer to remove with the mattock can be dug out with the spade in from



OPERATING ON A GORSE BUSH WITH THE DRAINING SPADE.

[Photo by E. B. Levy.]

three to four minutes. In the case of a big clump the spade is used first of all to clear round the base by cutting off the low branches ; then the surface roots are cut by sharp downward blows around the base of the plant about 9 in. from the stem. The spade is next driven down under the crown to cut the tap-root, and the plant is levered out. This is the quickest and best hand implement I have yet seen for the purpose.

—C. J. Hamblyn, B.Agric., Instructor in Agriculture, Whangarei.

BOARD OF AGRICULTURE PERSONNEL.

THE following have been appointed members of the Board of Agriculture for the triennial period ending 30th April, 1932 :—Hon. D. Buddo, Messrs. J. Begg, O. Donald, W. B. Grant, D. Marshall, W. W. Massey, W. Morrison, W. Perry, W. D. Pike, F. S. Pope, H. B. Stuckey, and D. W. Westenra, Mr. Perry has been named as President of the Board.

SEASONAL NOTES.

THE FARM.

SPRING-SOWN CROPS.

THE continuous wet weather experienced during July and on into August has greatly delayed all farm operations, especially in connection with the sowing of cereal crops. However, as opportunity offers this work should be pushed along and the best made of a late season. If a farmer finds he is too late for wheat, then oats or barley may be sown.

It has previously been noted that the tendency is for farmers to rely more and more on grass, and to reduce the areas of roots sown. Simultaneously with this there has been the desire to produce the best crop the smaller area will grow. This is as it should be. Great care should be taken to select the best strains of the type of crop it is decided to grow, and sow it under the very best conditions. This necessitates the selection of suitable land, the preparation of a good seed-bed, the full supply of a suitable fertilizer, and careful sowing and after-cultivation.

The varieties and kinds and quantities of fertilizers should be those that have proved most efficient in the district, and if the farmer is at all doubtful he can always get reliable information from the Instructor in Agriculture for his district. This officer is in close touch with all experimental work carried out by the Department of Agriculture, and in addition to this he has the results of the various farmers' field competitions and the actual practice of a large number of the most successful farmers in the district to guide him.

Rape, mangel, and carrot crops will, after the cereal crop, be the next to require attention, and, as has been repeatedly pointed out in the past, ploughing for these should be done as early as possible, followed up by frequent workings so as to destroy weeds and give the land the assistance of the sun to sweeten it. The destruction of annual weeds before sowing is of the greatest importance, and where the land cannot be ploughed early enough to enable this to be done, many successful farmers prefer to plough and sow at once, with the hope that the crop will get established before the weeds get too strong a hold. This is not good farming, but is certainly better than a half-worked field full of weeds. In preparing a seed-bed for roots care should be taken that it is fine from the bottom upwards. The question of the condition of the actual top soil is open to considerable difference of opinion. In districts with a light rainfall it is all right to have it fairly fine; but where the rainfall is heavy there is danger of it running together after sowing and spoiling the germination. Frequently newly sown fields that have had a heavy rain on them are covered with a thin crust which it is difficult for the seed to break through.

The best general practice for spring sowing is to leave the surface just a little rough in order to prevent this running together. Seeding may be done as early as the weather will allow, but it is bad practice to sow before the land is sufficiently warm to bring about a rapid germination. Unless these conditions exist the seed is better in the bag. Quick germination to get ahead of weeds should always be aimed at.

AUTUMN- OR WINTER-SOWN CEREALS.

Autumn- or winter-sown cereal crops require attention at this period. Frequently the surface of the land has run together as a result of heavy rains and the crop is not making satisfactory growth. One or more strokes of the tine harrow where these conditions exist will often work wonders. Care must, of course, be taken to see that the land is sufficiently dry to allow the harrows to go into the ground. Remember that it is necessary to loosen the soil up, not just draw the harrows over the field. One is not likely to do any harm by overharrowing. If the crop is at all yellow at this period it will generally pay to top-dress with 1 cwt. per acre of a good nitrogenous fertilizer—sulphate of ammonia or some other giving about the same amount of nitrogen. For full particulars of the treatment of cereal crops with nitrogen see this *Journal* for April, 1929, page 221. Reprints of the article referred to are obtainable from all Instructors in Agriculture or Fields Instructors of the Department.

PASTURES.

Pastures will now be making fair growth, especially in the earlier districts, and it is important that they should receive the best of management to ensure full returns during the growing season. If for any reason top-dressing has not been done, and it is still desired that this work should be carried out, there is plenty of time, provided a quick-acting fertilizer such as super is used. Many very successful dairy-farmers now follow up the practice of top-dressing in the autumn, with another dressing in September, and this system has a great deal to commend it. A nitrogenous dressing may also in some cases help at this period.

FIELDS FOR ENSILAGE OR HAY.

Fields intended for ensilage should be thoroughly cleaned and shut up as early as they can be spared. A careful clearing-up at this time, particularly of any wire or other foreign material, will save a great deal of trouble at mowing-time. The early shutting-up is most important, as it allows the grass to get a sufficient growth to allow it to be cut during November or very early in December. If this is done the grass is saved at its best, and the pastures are enabled to recover and get a good growth of clover and fine grasses before the dry weather sets in. This means that the clovers and better grasses are preserved in the sward. Ensilage-making should become a standard practice on every dairy-farm and on a great many sheep-farms. In addition to the advantages just mentioned, ensilage-making means that one is independent of the

weather, as it can be saved during showery weather just as well as in dry. It is practically safe from fire, and will keep for years if not required in the meantime. It is proposed to deal with methods of ensilage-making in the September *Journal*.

Fields for hay should also be cleaned and shut up, so as to have them at their best when the local weather conditions are considered likely to be right for haymaking. All fields to be shut up for ensilage or hay should be given 2 cwt. per acre of super at time of closing. If very rich in clover, 1 cwt. of sulphate of ammonia could also be applied with advantage. If, however, the clover content is already light no nitrogenous fertilizer should be used.

LUCERNE.

The growth on lucerne-fields will now be coming away, and it is a good time to shut them up, so as to get the the first cut off as ensilage, and have a second cut ready about the New Year for hay or green feed. The question as to whether a farmer should cultivate his lucerne at this period of the year or not often causes considerable thought. In dry districts spring cultivation is all right; but where the spring is wet it generally does more harm than good. If the land is dry enough a stroke or two of the tine harrow just before shutting up will help, otherwise it is best left until the autumn, which is really the proper time to cultivate lucerne.

—*Fields Division.*

THE ORCHARD.

SPRING WORK.

SPRING may be regarded as the beginning of a new season's work in the orchard, and the main activities will be those of spraying, cultivation, manuring, and in some cases grafting. In successful orchard-management work must necessarily be planned ahead, so that each operation may be undertaken and completed in its proper season. Pruning, if not already completed, should be pushed forward with all possible speed, and the orchard cleaned up ready for spraying operations, which must not be hampered in any way. It may be assumed that the spray outfit received its annual overhaul during the winter and new hoses procured where necessary. Nothing must be left to chance in connection with spraying operations, as a hold-up at such a critical time might prove to be a real disaster.

Successful control of disease in the orchard depends mainly on three important considerations—the time of application of a specific, the strength and suitability of the material for the particular purpose, and the thoroughness with which it is applied. Having numerous diseases and insect pests to control, the liability of certain materials to damage foliage and fruit if applied wrongly, and the different behaviour of varieties, make control measures somewhat complex for a beginner. Further advice may be secured from the Orchard Instructor for the district, however. The general health of the tree should be considered in connection with disease-control.

A tree weakened through continuous heavy cropping and lack of general attention is more liable to suffer spray injury than a tree carrying healthy foliage, thus making disease-control difficult, owing to the fear to apply sprays at sufficient strength for the purpose. Mildew is often a result of this general debility, and nothing but a reinvigorating of the tree by very hard pruning, better cultivation, and manuring will restore health.

SPRAYING OPERATIONS.

Pip-fruits.—It is usual to begin the season by applying an insecticide spray at the late dormant stage—usually the beginning of September—or at the very beginning of bud-movement. Red oil is the popular insecticide for this period, and used at a strength of 1-15 will clean up scale insects, &c., on apples and pears.

It may not be necessary to use this expensive spray every year on all varieties, especially on varieties of apples which receive strong applications of lime-sulphur for foundation sprays in the programme for the control of fungus diseases, as lime-sulphur in itself is a good insecticide. However, periodical applications of oil are advisable and necessary for the welfare of the tree. Lime-sulphur, 1-15, at green-tip, followed by a second spraying, 1-35 to 1-50, when the flower-buds are well expanded or showing some colour, may be applied to varieties of apples less liable to black-spot attack and probably more susceptible to powdery mildew.

Varieties such as Delicious and Dougherty usually receive a bordeaux spray, strength 6-4-50, at the green-tip stage, followed by lime-sulphur, 1-35, at the open-cluster stage. Bordeaux used later than the green-tip may cause serious russetting. Varieties receiving this initial fungicidal spray of bordeaux would require a late dormant oil spray.

For the control of black-spot on pears bordeaux is recommended, the first application being made at green-tip, strength 6-4-50, followed by a 3-4-50 mixture at the pink stage. Lime-sulphur may be used in place of the second bordeaux on such varieties as P. Barry, Josephine, and Winter Cole, which are less liable to attacks of black-spot, and do better under lime-sulphur treatment.

Stone-fruit.—For the control of leaf-curl, shot-hole, &c., on stone-fruits bordeaux must be used, the first application at bud-movement, strength 8-6-40, probably having been already applied. On varieties particularly susceptible to leaf-curl, a second application should follow at the pink stage, at strength 3-4-40. Sometimes lime-sulphur, 1-50, is used at the pink stage, and is probably an important application for brown-rot control. The stone-fruit grower, however, should be prepared to fight brown-rot from the fruit-set period with sulphur in the precipitated form, 10 lb. to 100 gallons, or dry-mix sulphur (16 lb. sulphur, 5 lb. lime, 8 oz. casein, in 100 gallons). The times of application will depend on weather conditions. It may prove necessary at times to allow not more than a week between sprayings.

CULTIVATION.

The value of good tilth in the orchard during the summer is fully realized. However, to be certain of securing that good

tilth, early preparation is necessary. Cover-crops, if growing, should now be turned under and allowed to rot before dry weather sets in. If no autumn ploughing has been done, the land should be turned over as early as possible if conditions are suitable. Where the land has been autumn ploughed, further cultivation work may be deferred for a short time, but the land should be worked down before growth begins.

MANURING.

It is reasonable to assume that fruit-trees, particularly heavy-bearing ones, remove each year large amounts of available plant-food from the soil, and that unless a regular and adequate supply of such plant-food is made available trees must decline in growth and productiveness. By cultivation we help the changes constantly going on in the soil whereby plant-food becomes available. However, it is recognized nowadays that this supply of plant-food must be supplemented by the use of fertilizers, otherwise production will go down. On the other hand, by a studied application of fertilizers production may be increased sufficiently to give a good margin of profit over the cost of manuring. If quick-acting chemical fertilizers are being used, applications should be made just before bud-movement, giving a dressing of from 4 lb. to 8 lb. of a complete fertilizer per tree, in the proportion of 1 lb. sulphate of ammonia, 4 lb. superphosphate (44/46 per cent.), and 1 lb. sulphate of potash.

GRAFTING.

The reworking of trees by the grafting method may be undertaken as soon as growth begins. From the middle of September, trees are usually in a fit condition, but the work should not be carried on after the middle of October. Scions must be in good condition—that is, quite sappy, but not too forward. Clean cutting, good binding, and exclusion of air about the union are three important points to effect if this operation is to be successful. Carelessness in these details, and a resultant poor “take” of grafts, means a year lost and probably some detriment to the stock. Binding may be done with raffia or with strips of waxed cloth. In the former case grafting-wax is smeared round the union.

The popular method of reworking old stocks is by rind-grafting. The scion, consisting of a length of the preceding year's growth—preferably about the thickness of a lead-pencil and shortened to three buds—is cut to a wedge; a short cut is made vertically through the bark of the stock, and the bark on one side of the cut is lifted carefully to admit the scion; the wedge-shaped scion is pressed down beneath the bark of the stock; one edge of the wedge of the scion is pared off while being prepared, so that this edge will lie against the unlifted edge of bark on the stock when the scion is pushed home.

FRUIT IN COOL STORE.

Fruit in cool store should be examined frequently for condition. This applies particularly to pears and large-sized Sturmers, which should be marketed early if showing signs of maturity.

—N. J. Adamson, Orchard Instructor, Hastings.

Citrus-culture.

Planting.—This is the most desirable period of the year for planting out the various varieties of citrus-trees. Soil conditions are now becoming more congenial, and showers may be expected to assist the trees to establish.

The most important factor in planting is that the soil shall be in good condition, well worked, friable, and by no means sticky when the soil is filled in round the roots; if sticky, it is impossible to get the desired firmness of planting without unduly consolidating the soil. The subsoil immediately under the tree should not be disturbed to a greater depth than the surrounding subsoil has been worked. The hard ball of earth round the roots as received from the nursery should be broken up and the roots evenly spread, and the soil well firmed, except the top 2 in., which should be replaced quite loosely. Fertilizers—say, 1 lb. of blood-and-bone—may be worked in round the tree after planting, or mixed with the soil used to refill the hole, but never dusted into the hole in such a way as to allow the roots to come in direct contact with the fertilizers.

If the situation is in any way exposed to wind, young trees should be supported with a strong stake inclined towards the prevailing wind, and securely tied, but in such a way as not to injure the tree.

Established citrus-trees will greatly benefit by an application of artificial fertilizers, or farmyard manure if such is available. An amount of 4 lb. blood-and-bone, 4 lb. super, and 2 lb. sulphate of potash should be applied to each tree which is in bearing, and a lesser quantity in the same proportions for smaller trees.

Cultivation.—All citrus-groves should be worked, so as to turn under any green crops or weeds and permit decay before the dry weather sets in.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

FINAL HATCHING.

It may be well to again stress the great importance of placing the last of the eggs for the season in the incubators or under the natural mother before the end of September, or early in October at the latest. There are many factors to be considered in successful poultry-keeping, but none of greater importance than the avoidance of late-hatched stock on the plant. It is a weak policy, even in normal times, to delay hatching operations beyond the right season, but in these days of high-cost foodstuffs and low-priced eggs it is particularly important that the young birds be hatched out during the early season.

There is yet ample time to hatch out ducklings for the renewal of the laying flock, but September should see all eggs undergoing the process of incubation for the production of ducklings for the Christmas market. To cater for this trade the eggs should be put

down about fifteen weeks before the young birds are to be marketed. This will allow twenty-eight days for hatching (the natural time), and the remainder for rearing the birds to prime condition. One little point may be mentioned here in regard to mating ducks. They should be mated well in advance before the eggs are required for hatching purposes, otherwise a high proportion of infertile eggs may be expected. Usually ducks, especially the heavy breeds, have to be mated much longer than fowls in order to ensure a maximum number of fertile eggs.

CHICKS DEAD IN SHELL.

Quite a number of poultry-keepers have sought my advice regarding troubles met with in their work of incubation, the chief trouble being the finding of fully developed chicks dead in the shell at hatching-time. How to advise is a problem, as no definite cause can be attributed to this condition. It may be due to one or a combination of causes. The breeding-stock may be responsible—breeding from overfat hens that have insufficient exercise, or birds that have been overforced for egg-production, may easily account for the chicks failing to hatch.

Like many other troubles met with in producing chicks by artificial means, the one in question can only be satisfactorily dealt with by taking into account all the local conditions surrounding the parent stock and the development of the chicks during all stages of the incubation process. Very often in a close examination of the eggs which do not hatch many things may be observed indicating a probable reason for the failure. Sometimes it will be found that the chick is so large that it would be impossible for it to make the natural movements to cut its way out of the shell. In other cases the air-cell is dried down too far, and the membrane under the shell is so tough that the chick cannot pierce it, and consequently dies in the shell. In the work of incubation the aim should be to have the air-cell almost one-fourth the size of the egg at pipping-time—in other words, dried down to where a chick would be expected to pip when under the natural mother. The size of the air-cell can be controlled to a great extent by the amount of cooling, ventilation, and moisture applied during the various stages of the incubation process.

Where it is found that the air-cell is drying down too fast moisture should be applied to check this, either by putting water in the trays provided or by keeping the floor of the incubator-room in a moist or more or less wet condition. Besides this the ventilation space should be reduced. On the other hand, where the air-cell is not coming down to a desired line at, say, about the fourteenth day, and the eggs appear when testing to be more or less clear just under the line of the air-cell, the presence of excessive moisture is usually indicated. In this case the ventilators should be opened wide to allow the moisture to escape. If the cell is considered to be too small, and the egg appears to be dark right up to the membrane enclosing the air-cell, this indicates that the chick is growing too fast, and if not checked will be too large at the pipping stage to turn in the shell, thus failing in its effort

to hatch out. This no doubt accounts for the remarks so often heard that the chicks found dead in the shell are usually of exceptional size.

Where it is found that the chick is making too rapid growth the only safe course is to reduce the amount of ventilation and cooling, in order to prevent the developing chick from obtaining too much oxygen and thereby growing to an unnatural size.

Study of the air-cell is thus a matter of vital importance, for upon the operator's knowledge of how and when to apply moisture, cooling, and ventilations, depends largely the success or otherwise of the incubator work. The importance will thus be seen of carefully studying the diagrams shown in the usual book of instructions supplied by the makers of incubators, indicating what the conditions of the air-cell should be at the various stages of the incubation period. As to the air-cell theory, it may be said, and rightly so, that eggs may be found with greatly varied sizes of air-cell at practically all stages of incubation. There is usually, however, a cause for this which does not prove the air-cell theory to be wrong. For example, where washed and unwashed eggs are placed in the same incubator the unwashed will dry down much more rapidly than the washed, resulting in ununiform air-cells. The same applies where stale and fresh eggs are set together, as, obviously, the more stale an egg is the larger will the air-cell be at the outset. For this reason eggs intended for incubation should be as near the same age as possible. Where eggs of different ages are used a more uniform air-cell can be struck by placing moisture in the machine for the first three or four days. In this way the stale eggs with more dried-down air-cells (as compared with those that are fresh), owing to the evaporation of moisture that has taken place, will take up to some extent the added moisture, and consequently more even air-cells will result.

While the studying of the air-cell is of importance in the management of an incubator, the fact cannot be emphasized too strongly that this and the carrying-out of other necessary details will count for little if extreme variations of temperature are allowed to take place. Especially should a fluctuation of temperature be guarded against during the first few days, or trouble is almost sure to be experienced at hatching-time. In speaking of the importance of a uniform temperature, it may be well to point out that thermometers do not always register the correct degree of heat that is being maintained in a machine. A case in point recently came under my notice. Three new thermometers were purchased; these had stamped upon them "guaranteed," but on being tested showed different readings of temperature up to 5 degrees. It is always a wise course to test a thermometer before use in connection with incubator work.

How to test a thermometer: Place a clinical thermometer and the one to be tested in water at 100° F., stir gently, add slowly at the same time hot water, and observe the different readings. If the incubator thermometer reads, say, a degree lower or higher than that of the clinical one it must be worked a degree higher or lower accordingly.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SPRING WORK.

By the time these notes appear the first examination of the hives should have taken place. As stated last month, the question of stores is of first importance, and every effort should be made to provide the bees with ample food to carry them on until nectar is available. Owing to the comparative severity of the winter this year, particularly in the South Island, it may be found in many cases that the bees have not consumed as much honey as usual. The weather conditions will probably also have influenced brood-rearing to a large extent, and, although brood may normally be found in the hives by the end of July, this year abnormal conditions have prevailed, and it will be unwise to judge a colony queenless because there is no brood showing at a first examination. With the advent of warmer weather the colonies will soon build up to their usual strength.

When colonies are weak, or show other signs of a poor queen, it is best to kill the queen and unite the colony with a stronger one. It is useless to try and carry a poor colony on to the summer. By the time new queens are available it will have nearly dwindled out of existence—if it has not been robbed out: and even if it lives until it can be requeened it will hardly build up sufficiently to give a surplus in the coming season. Only strong colonies should be tolerated in an apiary, and it is much the better plan to dispose of all the weak stocks and prepare the hives thus vacated for increase later on. A simple method of uniting is to place the weak colony over the strong one with a single sheet of newspaper between the two hive-bodies. The bees will gnaw the paper through and unite quite peacefully in a day or two.

PRECAUTIONS AGAINST ROBBING.

All work which necessitates opening the hives should be carried out as expeditiously as possible, and no hives left open longer than can be helped. No combs should be exposed to the bees at this time of the year. It is a good plan to carry round on a barrow an empty super, in which the end combs can be placed and covered while the work of examining the colony is going on. It is necessary to remove one comb at least, so that the rest may be easily handled, but this comb, however dry, is as well kept out of the way of would-be robbers. Spring robbing, once started, may become as disastrous as autumn robbing, and must on no account be encouraged. All feeding should be carried out just before dusk, and if any syrup is spilled it should be at once covered up or removed out of harm's way.

STARTING AN APIARY.

The beginner who is desirous of starting an apiary may commence at any time now. For the next month or two he will only be able to obtain established colonies, as swarming is still some time ahead. If he decides to commence at once, and thus obtain

the full benefit of the season's experience, he should get into communication with a reliable breeder and obtain nothing but absolutely guaranteed stock. On no account must the tyro be led away by the apparent cheapness of bees offered for sale. If he contemplates purchasing any other than those of any apiarist who makes the sale of bees his business he should have his prospective purchase examined by some person of experience, and be quite certain of the cleanliness of the colonies before taking possession. The sale of diseased bees is forbidden by law; but, apart from that, they are a dear bargain, as they will cost much in money and time to bring them to a healthy condition, and, moreover, will yield nothing during the first season. A good hive purchased now, placed in a sheltered position, and carefully watched to see that its stores are sufficient to last it till nectar is abundant, will probably (if the apiarist desires it) yield a good swarm, and both parent hive and swarm should give a surplus when the main honey-flow arrives.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

BOXES of seedling plants will now be to hand from the nurseries ready for pricking out into the plant-beds. For this purpose the plants should be well hardened off, and to make sure of this they should be placed on the beds for a few days at least to prove their condition. Place the hessian cover in position over them, and keep them slightly on the dry side. If they prove satisfactory, water them well the day before they are to be planted out. Then with the planting-board open a small trench across the bed and place the seedlings $1\frac{1}{2}$ in. apart, carefully covering the roots. The opening of the next trench, $1\frac{1}{2}$ in. distant, completes the closing of the trench already planted. In about five days the plants should have begun to establish themselves in the soil, and should be showing indications of further growth. From eight to ten days after planting, when the young plants are well established, water the plants with a solution of one eggcupful of nitrate of soda in a kerosene-tin of warm water. The plants usually grow quickly and will smother any weeds. The plants should be ready for planting out in the field by the beginning of November.

If seeds have been sown in the plant-beds and germination is uneven, thin the crowded plants to prevent them becoming drawn and weak. These thinnings may be used for pricking out on bare patches on the beds. In either case cover the beds securely with cheesecloth or hessian to shade the plants and protect them from cold temperatures.

The preparation of the land in which the crop is to be grown will now consist of occasional light cultivation in fine weather to destroy weeds and aerate the soil. If lime has not been applied during the winter the dressing should be given now; from $\frac{1}{2}$ ton to 1 ton per acre is usually sufficient. This should be drilled or

broadcast and worked in with the cultivator. For land known to be poor in plant-foods make up a mixture of 5 cwt. superphosphate and 1 cwt. sulphate of potash; broadcast 2 cwt. of this one month after liming, and work it in; the remainder can be used as required after the plants are set out. The rates given are per acre.

TOMATOES.

The watering and ventilation of tomato crops under glass will require the closest attention if heavy and early crops are to be obtained. Drawing the plants up through keeping the house too close in warm weather, or chilling them by too much ventilation when a cold wind is blowing, are the commonest mistakes made with the crop at this season. Such treatment delays and diminishes the time and size of the first and more valuable bunches of fruit. The neglect is less likely to take place if this responsibility of attention to the houses is expressly assigned to one person.

The outside tomato crop often follows a winter crop such as celery or spring cabbage or cauliflower. This land is usually very rich, and when given a further heavy dressing of chemical fertilizers it is not surprising that the vigorous growth obtained is accompanied by black-stripe disease or late-blight. A better result in such cases will often be obtained by a dressing of lime harrowed in after the first ploughing, and a moderate application of superphosphate and sulphate of potash with the last cultivation before planting. The ensuing crop will be more healthy and thrifty, and can be easily "pushed" along, if considered advisable, by further applications of manures after it is established.

STRAWBERRY-BEDS.

Strawberry-beds that are not in vigorous condition will be much benefited now by a dressing of superphosphate and potash, 2 oz. of the former and 1 oz. of the latter per square yard is a moderate dressing. Much heavier dressings are given to plants on poor lands. Work the manures in with a light cultivation. Material for mulching the beds should now be obtained. Rushes and pine-needles are sometimes used for the purpose, and are quite satisfactory. Baled straw is also popular; if it is placed on the headlands to weather some time before use it is all the better.

THE MARKET-GARDEN.

Light hoeing in fine weather [to destroy seedling weeds among sown and planted crops is most important at this season, as it encourages crop-growth and makes light work of weeding.

Sow radishes, lettuce, spinach, main-crop carrots, beet, and peas. Plant main-crop potatoes and asparagus. The latter crop (asparagus) is becoming more popular, and is profitable on good moist sandy loams. It should be planted only after thorough preparation, as the beds remain down for many years. Where this preparation has been given open trenches 3 ft. to 4 ft. apart and 10 in. deep, plant good selected well-graded seedling roots 18 in. apart, and cover firmly with 2 in. of soil. Allow the trenches to fill gradually as cultivation proceeds during the summer. Intercropping may be

done during the first season, as long as the asparagus crop is not interfered with. Established beds should now receive a further dressing of fertilizer; 2 oz. each of superphosphate and nitrate of soda and 1 oz. sulphate of potash per square yard will generally be found suitable.

In the warmer parts of the North Island dwarf beans and vegetable marrows are sown towards the end of September. The practice of some growers to raise ridge cucumber plants now under glass for planting out later in the field for early cropping is profitable where a warm moist friable soil is available for the purpose.

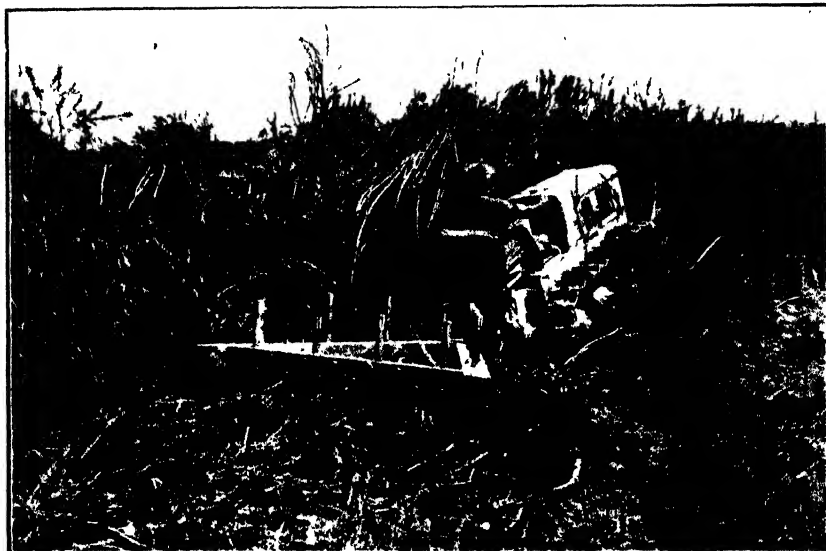
For many years slugs have taken a heavy toll in the garden at this season among seedlings and salads, and an indignant host of angry growers has formulated many recipes for defeating the attack of this persistent insatiable pest. Dusting a crop with lime just before retiring to rest is an irksome and unpleasant task. Of the many experiments with White Island Product, one of the most interesting and successful was a dressing applied to the land a week or two before planting-out lettuce seedlings, with the pleasing result of their being comparatively free from this invasion. Finely powdered alum mixed with twice its weight of lime is a good repellant dust for this purpose, or two tablespoonfuls of strong liquid ammonia to 3 gallons of water sprayed with a fine nozzle. Kainit or nitrate of soda are good slug-killers, as also is sulphate of copper. An amount of 1 lb. of powdered sulphate of copper and 20 lb. kainit, mixed and broadcast evenly on a suitable evening at the rate of 1 oz. per square yard, is given as a perfectly reliable remedy. Another is $\frac{1}{2}$ lb. quicklime dissolved in 4 gallons water, the clear liquid strained off when cold, and added to 1 lb. of alum dissolved in 1 gallon of water. The effect of any of these methods is best when they are applied after the slugs have come out to feed—that is, in moist weather for preference and after sunset.

Of the many recipes for defeating the woodlice pest in cold frames and glasshouses for seedlings, &c., the best has been demonstrated by Professor Theobald to be 1 lb. of fine powdered Paris green and 28 lb. bran. Mix them well together, and broadcast the material in a dry state at the rate of 1 oz. to the square yard. The soil should not be watered for some days after treatment.

WEED-KILLING IN THE HOME GARDEN.

The usual annual crop of weeds will now appear in the water-tables and at the sides of walks and drives. One or two applications of good weed-killer is the best method of dealing with this problem where the area is considerable. For this purpose sodium chlorate has been used in France and America with great success; it is even effective in destroying satisfactorily the troublesome convolvulus. It is not poisonous, but is inflammable, and directions given with it should be strictly adhered to. An amount of 100 lb. sodium chlorate dissolved in 100 gallons of water is sufficient for 1 acre of land—that is, 1 gallon for about 48 square yards.

—W. C. Hyde, *Horticulturist*, Wellington.



BREAKING DOWN AND TEARING OUT GORSE BY TRACTOR AND SWAMP-HARROW
ON THE FLOCK HOUSE TRAINING FARM ESTATE.



PLOUGHING GORSE-CLEARED LAND AT FLOCK HOUSE WITH TRACTOR-HAULED
SWAMP-PLOUGH.

This operation followed the breaking-down work shown in top photo and subsequent burning. The plough is claimed to be the biggest one of its kind built in New Zealand, turning a furrow 26 in. by 11 in

WEATHER RECORDS : JULY, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THE month of July was on the whole a cold, wet, and unsettled one, but except for a few occasions there was an absence of strong winds. Rainfall was again considerably above the average over most of the Dominion, though deficiencies were recorded in some districts. In the South Island these were experienced south of Westport, in Southland, parts of the interior of Otago, and at a few places in North Canterbury. In the North Island, places on the east coast and about Wanganui and Taihape received less than the normal. The greatest differences from the average occurred at Lambrook Station, Fairlie, with 263 per cent., and Timaru, with 169 per cent. above, and at Okuru, South Westland, with 60 per cent. below.

Temperatures were everywhere lower than the average for July. Frosts were fairly numerous and in some cases severe. There was in consequence little growth of pasture, but owing to the absence of high winds the actual damage to vegetation was very slight. Snowfalls were frequent and copious in the high country of both Islands, though none lay for any time on the low levels.

The most notable meteorological feature was the tendency for anti-cyclones to pass north of New Zealand. There was only one which proved an exception in this respect - namely, that which moved across the Dominion between the 3rd and 5th. Fine weather prevailed generally on these three days.

Cyclones were again very prevalent, and even when depressions were of the westerly type originally they had generally developed cyclonic form by the time they reached the Dominion. The first of the more severe cyclones experienced moved on to New Zealand on the 7th, and at 9 a.m. was centred off the west coast of the South Island. During the night of the 6th, north-easterly winds increased to gale force in many parts, and at Christchurch the wind was exceptionally violent. Rain set in and became general on the 7th. The Nelson and Marlborough Districts experienced particularly heavy falls at this time, and the resulting floods caused considerable damage through low-lying ground becoming inundated and through numerous landslips.

A week later, on the 13th, another cyclone advanced on to New Zealand, its centre being located off Puysegur Point on that date. This disturbance proved to be a slow-moving one, and a controlling influence over our weather was exercised by it until the 19th. This period was the wettest portion of the month. Heavy rains were recorded every day over large areas of the Dominion, and the total amount of precipitation produced by the storm was very great. On the 14th the Nelson District again suffered from floods, and serious damage was done. In Canterbury and Otago also floods resulted from the prolonged heavy rains. Main-road communication was interrupted both north and south of Timaru and on the Mount Cook route. The Taieri Plain was covered with water. Fortunately, ample warning was provided, and stock were removed to high land in time to prevent serious loss. {

By the 20th the cyclone centre had passed eastwards, and a brief respite of almost spring-like weather was experienced on this day. During the night, however, rain again set in with cold southerly winds. On the 22nd and 23rd, while an anticyclone was passing north of New Zealand, fair weather prevailed. From this date onwards, however, cold, changeable, and showery conditions were the rule, though mainly fair weather was experienced on the 27th and 28th.

RAINFALL FOR JULY, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitaia	9.39	23	2.00	5.96
2	Russell	4.21	16	1.09	4.97
3	Whangarei	5.98	23	0.95	7.26
4	Auckland	6.22	25	1.06	4.98
5	Hamilton	6.44	20	1.50	5.02
5A	Rotorua	6.90	11	2.00	4.89
6	Kawhia	6.70	20	1.50	6.16
7	New Plymouth	9.17	24	2.23	6.29
8	Riversdale, Inglewood	11.60	24	1.03	9.93
9	Whangamomona	7.02	13	2.05	7.35
10	Eltham	9.41	25	1.26	5.55
11	Tairua	5.90	15	1.78	5.25
12	Tauranga	4.72	16	1.26	4.86
13	Maraekakaho Station, Opoitiki	5.04	12	2.02	4.09
14	Gisborne	4.79	17	1.86	5.14
15	Taupo	5.37	12	1.05	3.83
16	Napier	2.00	15	0.67	3.90
17	Maraekakaho Station, Hastings	1.71	14	0.65	3.65
18	Taihape	3.34	21	0.92	3.15
19	Masterton	2.42	19	0.49	4.31
20	Patea	5.13	20	0.55	4.20
21	Wanganui	2.73	16	0.55	3.52
22	Foxton	3.71	13	1.01	3.09
23	Wellington (Karori Reservoir)	8.20	24	1.14	5.22
<i>South Island.</i>					
24	Westport	9.13	19	1.92	6.99
25	Greymouth	7.18	13	1.50	7.84
26	Hokitika	7.81	13	2.30	9.08
27	Ross	8.31	12	2.70	9.94
28	Arthur's Pass	8.69	13	2.70	11.55
29	Okuru, Westland	4.80	6	2.00	12.03
30	Collingwood	14.24	24	2.96	9.65
31	Nelson	9.21	13	1.64	3.49
32	Spring Creek, Blenheim	7.50	12	2.25	3.40
33	Tophouse	7.67	15	1.45	4.79
34	Hanmer Springs	3.71	14	0.66	4.59
35	Highfield, Waiau	3.16	10	0.84	3.44
36	Gore Bay	3.74	11	0.50	2.84
37	Christchurch	3.70	16	0.64	2.76
38	Timaru	5.20	10	1.58	1.93
39	Lambrook Station, Fairlie	9.47	10	3.68	2.61
40	Benmore Station, Clearburn	1.82	15	0.42	1.73
41	Oamaru	4.24	9	1.32	1.74
42	Queenstown	2.02	11	0.45	2.04
43	Clyde	1.27	11	0.26	0.94
44	Dunedin	6.24	17	1.74	3.01
45	Wendon	1.56	12	0.28	1.79
46	Gore	2.00	19	0.29	1.94
47	Invercargill	2.10	19	0.40	3.28
48	Puysegur Point	4.56	19	0.50	6.18
49	Half-moon Bay	2.20	16	0.69	4.13

—Edward Kidson, Director of Meteorological Services, Wellington, 6/8/29.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ENSILAGE FOR SHEEP.

F. J. ELLIS, Bulls :—

I should be glad of any information you can give me in regard to feeding ensilage to sheep, more particularly to ewes in lamb and with lambs; whether it is desirable to feed alone or in conjunction with hay, and any other useful information connected with the matter

The Live-stock Division :—

As a foodstuff for ewes in lamb ensilage is not considered satisfactory. There is a danger of severe digestive disturbances being set up, the main issue being the harmful acids and moulds which result from improper fermentation of the ensilage. There is also the danger of in-lamb ewes not taking sufficient exercise, predisposing them to "bearing-trouble" and ante-partum paralysis. Ensilage is a foodstuff which must be fed with great care in the case of ewes. Only very small amounts daily should be allowed at the commencement, and as this is a succulent feed, hay should be given in addition. Under such circumstances the necessity of forced exercise in pregnant ewes cannot be overlooked. The feeding-value of well-prepared ensilage is superior to that of roots, but mouldy or sour ensilage should not be used under any circumstances for pregnant ewes.

TREATMENT FOR SOD-BOUND PASPALUM PASTURE.

L.A., Titirangi :—

Can you give any information as to how to deal with sod-bound paspalum pasture? We have a paddock which has been down for over fifteen years, and is in such a bad state that it throws little feed, and very poor quality at that. The roots form such a dense mass as even to exclude water from the soil, the rain-water being held as in a sponge by the root-system. I notice also that moss is bad in this paddock. The land has a clay subsoil, is hilly in contour, and is easily ploughable.

The Fields Division :—

Neglect of top-dressing and thorough harrowing is a contributing cause of the sod-bound condition of paspalum, and many sod-bound pastures can be brought back by systematic harrowing and regular top-dressing with phosphates. Given the conditions mentioned in your letter, the best plan for rejuvenating your pasture would be to plough and resow in rye-grass and clovers. Plough the land in the late winter, with the furrow-slices lying on their edge; avoid turning the paspalum turf right under. Roll on the furrow, and disk and sow in September about 15 lb. of perennial rye-grass, 2 lb. crested dogstail, 2 lb. red clover, and 1 lb. white clover. Fertilize with 3 cwt. of basic slag. The paspalum will root again in the fresh soil which has been turned up, and will come up in a rejuvenated condition along the edges of the furrow-slices. Given good management and top-dressing you should be able to maintain a rye-grass-paspalum pasture, following the establishment of the rye-grass and clovers after ploughing.

CANKER IN DOG'S EAR.

F. H. WALLIS, Whakapirau :—

I have a valuable young sheep-dog about eighteen months old, which for the last six months has been badly troubled with his ears. I am told it is "canker." The inner portions of both ears swell until there is a complete blockage. This causes him to scratch his head a great deal and whine as though

in pain. I have tried washing with disinfectants and applying lard and sulphur, also olive-oil. At first this treatment seemed to do good but is now of little use. I would like your advice as to treatment, &c.

The Live-stock Division :—

Canker in the ear of a dog is usually caused by a small mange-mite, and therefore may spread to other dogs which come into close contact with one affected. The local treatment advised is to clean the affected part very gently with a wad of cotton-wool soaked in a mixture of one part methylated spirit and five parts water. This should be done weekly throughout the treatment. Every second day a few drops of citrine ointment (one part) and olive-oil (eight parts) should be dropped into the ear. It would be advisable to obtain, say, 4 oz. of this mixture from a chemist. The cheeks and the outer side of the ears should be washed with some disinfectant occasionally. The general treatment is to provide the dog with warm dry quarters and to give him daily exercise.

STORING SWEDES FOR SHEEP.

“SUBSCRIBER,” Waihao Forks :—

In carting out swedes from the paddock to sheep in June, July, and August we often experience difficulty because of the boggy state of the ground owing to winter rains. If the swedes were carted off early in May and heaped, would they be as palatable and nutritious as if carted fresh from the ground? How long would they keep pitted?

The Fields Division :—

It is not likely that your swedes would have finished growing until the end of May. They could then be carted off the field and placed under the shelter of a plantation or hedge and covered with straw. If the tops were removed the roots would keep until the end of August. Stock generally show a preference for roots that have been stored, as long as they have been kept in sound condition, and the amount consumed is apparently less than when eaten off in the paddock.

SUSPECTED COW-POX.

W.H.A., Glenavy.—

Some of my cows have lumps forming in the udder. They come to a head like a boil, and discharge. Could you tell me what the trouble is and a cure for it?

The Live-stock Division :—

The lumps referred to may be small abscesses which sometimes occur in the udder, or more probably they are cow-pox postules, which are infective and are often spread from cow to cow by the milker's hands or cloths used in washing the udder. If the former, keep the parts clean by using a weak solution of permanganate of potash (Condy's crystals); but if the latter (which we suspect), besides keeping the affected udder clean and dry it is advisable to milk the animals with care, the affected cows being milked last and the hands well washed after milking. A little zinc ointment should be applied to the ulcers.

Condition of Dairy-farm Milking Sheds.—During the year ended March, 1929, the Farm Dairy Instructors of the Agriculture Department visited 45,683 sheds. Of this total, 22,222 sheds were classed as good, 21,387 as fair, and 2,074 as bad.

The plant Tourretia volubilis has been declared to be a prohibited plant within the meaning of the Prohibited Plants Act, 1927. *Tourretia volubilis* is a half-hardy twining plant, native of Peru, with tetragonal branchlets, opposite compound leaves, furnished with branched tendrils. Flowers in terminal racemes, corolla of a dusky violet colour, fruit an oblong capsule with rather woody walls furnished with hooked spines, seeds few; rarely grown in gardens, and usually treated as an annual; member of the Bignoniaceae.

EXPORTS FROM NEW ZEALAND FOR YEARS ENDED 30th JUNE, 1928 AND 1929.

Commodity.	Unit.	Quantity.		Value.	
		1927-28.	1928-29.	1927-28.	1928-29.
<i>New Zealand Produce.</i>					
Butter	Cwt ..	1,467,954	1,567,393	£ 11,315,750	£ 12,744,992
Casein	" ..	44,372	46,016	141,430	140,913
Cheese	" ..	1,529,872	1,661,000	6,360,766	6,889,993
Fish	" ..	24,702	24,741	85,562	86,077
Honey	lb. ..	1,975,300	2,565,795	64,529	89,241
Beef, frozen ..	Cwt ..	692,231	509,738	977,623	808,266
Lamb, frozen ..	" ..	1,865,784	1,879,680	6,669,196	6,925,831
Mutton, frozen ..	" ..	1,045,937	961,247	2,085,607	1,949,919
Pork, frozen ..	" ..	127,297	190,740	374,935	589,609
Beef, salted ..	" ..	4,990	2,305	10,685	5,284
Meats, potted and preserved	" ..	68,316	53,495	237,306	198,323
Sausage-skins ..	lb ..	3,715,870	3,574,661	766,345	688,098
Milk, preserved ..	" ..	1,091,497	2,060,813	27,513	49,069
Milk, dried ..	" ..	12,414,035	16,083,585	318,964	361,625
Peas	Centals	207,917	143,817	179,935	112,623
Oats	" ..	260,739	25,466	111,155	13,373
Apples, fresh ..	lb. ..	39,651,282	32,171,840	496,870	447,509
Hops	" ..	406,350	282,979	22,612	15,942
Potatoes	Tons ..	951	1,056	7,755	8,298
Live-stock .. ..	" ..	..	..	114,224	117,710
Calf-skins	Number	750,408	741,923	245,947	300,197
Hides, horse and cattle	" ..	451,476	355,490	903,834	677,552
Rabbit-skins ..	" ..	12,333,438	11,278,431	633,090	555,811
Opussum-skins ..	" ..	133,344	152,430	77,587	102,812
Sheep-skins with wool	" ..	1,371,790	1,179,788	488,206	464,303
Sheep-skins, without wool	" ..	8,626,621	8,729,575	1,296,428	1,473,253
Wool	Bales	667,225	687,833	16,548,869	15,923,157
Phormum fibre ..	Tons ..	13,921	13,620	391,759	371,520
Seeds, grass and clover	Cwt. ..	75,827	55,935	291,161	172,621
Tallow	Tons ..	29,510	21,352	882,297	719,099
Coal	" ..	120,688	177,343	172,468	247,228
Kauri-gum	" ..	4,588	4,517	245,834	247,094
Gold	Ounces	125,855	120,506	518,468	495,456
Silver	" ..	437,609	434,501	43,711	43,288
Leather .. ..	" ..	..	..	20,787	16,206
Timber, sawn ..	Sup. ft.	35,389,421	37,617,329	398,474	408,158
Other New Zealand produce	" ..	..	..	656,857	827,957
Total .. ..	..	..	..	54,184,545	55,288,407
Re-exports .. ..	..	..	..	1,434,740	956,343
Total exports ..	..	..	..	55,619,285	56,244,750

Sterilization of the Churn.—Live steam blown into butter-factory churns after they have been properly washed is a most effective means for keeping them in a sweet condition

CERTIFICATION OF SEED POTATOES.

CERTIFICATES ISSUED ON FINAL TUBER INSPECTION, SEASON 1928-29

FOLLOWING is a list of growers whose crops have been subjected to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture, thus qualifying for certificate. The list comprises those crops passed up to 31st July. Further lists will be published later.

<i>Auckland Short-top (N.Z. Sutton's Supreme)</i>				Acreage.
F. Brundell, Camside, Kaipoi	..	..	..	5
W. Eder, R.M.D., Sefton	..	..	..	11
A. J. Rich, R.M.D., Kaipoi	..	..	..	16
Weeber Bros., Englefield Road, Belfast	..	..	..	4
<i>Auckland Tall-top (N.Z. Sutton's Supreme)</i>				
J. Bailey, R.M.D., Kaipoi	..	..	..	7
<i>Dakota :—</i>				
E. S. Barnes, Hinds, Lowcliffe R M D	..	..	..	2
W. J. Crozier, R.M.D., Mitcham	..	..	..	3
H. M. Marshall, R M D., Weedon's, North	..	..	..	2
E. Thompson, R M D., Weedon's, North	..	..	..	12
C. E. Walker, jun., R M D., West Melton	..	..	..	3
<i>Arran Chief</i>				
G. Jones, Vale Royal, Halswell, Christchurch	..	..	..	4
F. Saunders, Studholme Junction	..	..	..	5
<i>Up-to-date</i>				
C. E. Walker, jun., R M D., West Melton	..	..	..	6
F. Westaway, R M D., Courtenay	..	..	..	8

NOTE.—A list of crops which had passed the field inspection and qualified for provisional certificate was published in the May issue of this *Journal*.

VARIETIES OF APPLES AND PEARS EXPORTED. SEASON 1929.

THE following particulars of the varieties of apples and pears exported from New Zealand in the past season have been compiled by the Horticulture Division from export certificates. The figures for apples represent 1-bushel cases, and those for pears crates consisting of three trays, each tray containing from 10 lb. to 12 lb. of fruit

Apples. Sturmer Pippin, 276,953; Delicious, 204,368; Jonathan, 155,246; Dunn's, 69,414; Cox's Orange, 47,825; Dougherty, 45,173; Statesman, 25,290; Cleopatra, 11,595; Rome Beauty, 10,767; London Pippin, 9,730; Worcester Pearmain, 8,567; Ballarat, 8,540; Stayman's Winesap, 5,180; Rokewood, 5,075; Lord Wolseley, 4,920; Scarlet Nonpareil, 4,474; Premier, 4,100; Newtown Pippin, 3,869; Tasma, 3,729; Granny Smith, 2,505; Pioneer, 2,360; Alfriston, 2,059; Willie Sharp, 1,838; Adams Pearmain, 1,826; King David, 1,797; Salome, 1,479; Spitzenberg, 1,396; Stark, 1,293; Gravenstein, 938; Shorland Queen, 864; Parlin's Beauty, 814; McIntosh Red, 730; Yates, 770; Ribston Pippin, 670; McLiver's Winesap, 601; Simmonds Winter, 545; Brownlee's Russet, 502; Golden Pippin, 424; Brighton, 412; Blenheim Orange, 409; Boston Russet, 397; Crofton, 386; Hoover, 370; McMahon's White, 357; Stone Pippin, 336; Edward Pippin, 295; Frimley Beauty, 207; Scarlet Pearmain, 190; Tasma Pride, 187; Pride of Australia, 171; Baumann's Reinette, 169; Cornish Aromatic, 168; Wagner, 139; Grooby Dessert, 95; Rymer, 88; Giant Jemton, 71; Glengyle Red, 57; Celso, 55; Shepherd's Perfection, 53; Desert Gold, 38; Winter Banana, 38; Grime's Golden, 12; Total cases, 933,040

Pears.—Winter Nelis, 19,842; P. Barry, 15,955; Winter Cole, 9,673; Josephine de Malines, 3,840; Beurré Bosc, 1,895; Packham's Triumph, 1,493; Doyenne du Comice, 1,301; Vicar of Winkfield, 1,170; Beurré Clairgeau, 936; L'Inconnue, 668; Keiffer, 532; Glou Morceau, 308; Harrington's Victoria, 278; Beurré Easter, 259; Beurré Diel, 221; Beurre Capiamont, 198; Elizabeth Cole, 169; Duchesse D'Angoulême, 142; Beurré d'Amanli, 104; Twyford's Monarch, 50; Broome Park, 28; Winter Bartlett, 25; Howell, 24; Total crates, 50,111.

GRADINGS OF BUTTER AND CHEESE, SEASON 1928-29.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelve months ended 31st July, 1929 (the dairy industry year), were as follows:—

Butter: Salted, 79,481 tons; unsalted, 2,175 tons; total, 81,656 tons—an increase of 9.27 per cent. compared with the figures for the preceding twelve months.

Cheese: White, 59,058 tons; coloured, 27,547 tons; total, 86,605 tons—an increase of 14.32 per cent.

In butterfat equivalent the amounts for butter and cheese combined represent a net increase of 10.88 per cent. compared with those for 1927-28, hitherto the peak year. A new high-level record in annual butterfat production has thus been established.

FERTILIZER IMPORTATIONS: JUNE QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 30th June, 1929:—

Sulphate of ammonia: United Kingdom, 2,597 tons; United States, 370 tons. *Calcium cyanamide*: Norway, 2 tons. *Nitrate of Soda*: Chile, 1 ton. *Basic slag*: United Kingdom, 5,025 tons; Belgium, 31,778 tons; France, 75 tons. *Bonedust*: India, 50 tons. *Rock phosphate and guano*: Nauru, 42,124 tons; Makatea, 2,089 tons. *Phosphates (other)*: United Kingdom, 2,035 tons; Belgium, 12,444 tons; France, 110 tons; Morocco, 261 tons. *Kainit*: France, 145 tons; Germany, 162 tons. *Muriate of potash*: Germany, 3 tons. *Sulphate of potash*: France, 290 tons; Germany, 233 tons. *Potash fertilizers (other)*: Belgium, 30 tons; France, 1,210 tons; Germany, 1,496 tons. *Sulphate of iron*: United Kingdom, 19 tons; Australia, 18 tons. *Other fertilizers*: United Kingdom, 3 tons; Norway, 505 tons.

YIELDS OF POTATOES, SEASON 1928-29.

THE following table has been compiled by the Census and Statistics Office from a recent postal census among growers of 2 acres or over of potatoes, on holdings situated outside city or borough boundaries, together with estimates for areas from 1 acre to 2 acres. The object was to obtain verification of the returns made in connection with the general collection of agricultural and pastoral statistics earlier in the season, which takes place before the main potato crop is dug.

Land District.	Acreage.	Yield of Potatoes at Digging.		
		Table.	Other (Seed, &c.).	Total.
		Tons.	Tons.	Tons.
North Auckland	1,599	6,925	2,084	9,009
Auckland	781	2,804	1,450	4,254
Gisborne	264	654	236	890
Hawke's Bay	532	2,433	739	3,172
Taranaki	211	614	300	914
Wellington	1,564	5,943	3,083	9,026
Nelson	428	1,180	535	1,715
Marlborough	235	623	291	914
Westland	17	84	31	115
Canterbury	12,888	48,982	23,801	72,783
Otago	1,689	8,674	3,685	12,359
Southland	1,096	5,613	2,843	8,456
Dominion, 1928-29	21,304	84,529	39,078	123,607
Dominion, 1927-28	21,693	79,617	41,785	121,402

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No. 3.

MAIZE-GROWING IN THE BAY OF PLENTY.

PRESENT METHODS AND SOME SUGGESTED IMPROVEMENTS.

C. WALKER, H.D.A., Instructor in Agriculture, Te Puke

THROUGHOUT the Bay of Plenty district, in individual areas ranging from one to over a hundred acres, maize-growing has been an established practice since the early days of local settlement. At one time it was regarded as the chief means of gaining a living from the land in the region stretching from Tauranga to Opotiki, but with the advances made by dairying maize-growing has lost some ground and is now only of secondary importance. However, with an aggregate area of approximately 6,500 acres devoted to this crop annually, it is still of some considerable consequence to the local farming community.

SOILS AND CLIMATE OF MAIZE-GROWING LOCALITIES.

That part of the Bay of Plenty which is largely devoted to maize-growing consists of the coastal strip, rarely exceeding a depth of ten miles. In the western portion, comprising the localities of Tauranga and Te Puke, the country is gently undulating and of light pumice nature. In favourable seasons and with liberal manuring this type of soil gives highly satisfactory results with the first crop after grass, but succeeding crops are usually disappointing.

Extending farther to the east are the Rangitaiki Swamp, Whakatane Flats, and Opouriao Valley, with soils of the peat, peat and pumice, and heavier river-silt types respectively. Very good crops of maize can be obtained on these soils, even in the second successive year of growing. All these soils, as would be expected, are level and rather low-lying, so that drainage in some cases is not satisfactory. There is then a break in the maize-growing belt, as for thirty miles the hills skirt the sea-coast. At the eastern end of the Bay one again comes on a fairly extensive flat area at Opotiki. This area comprises the river-flats built up by the Waioeka and Otara Rivers, and is particularly fertile. In fact, it is only approached in fertility by the Opouriao Valley among the maize-growing districts. In the Opotiki district there is also an area of lighter undulating hill country very similar to that of Te Puke and Tauranga.

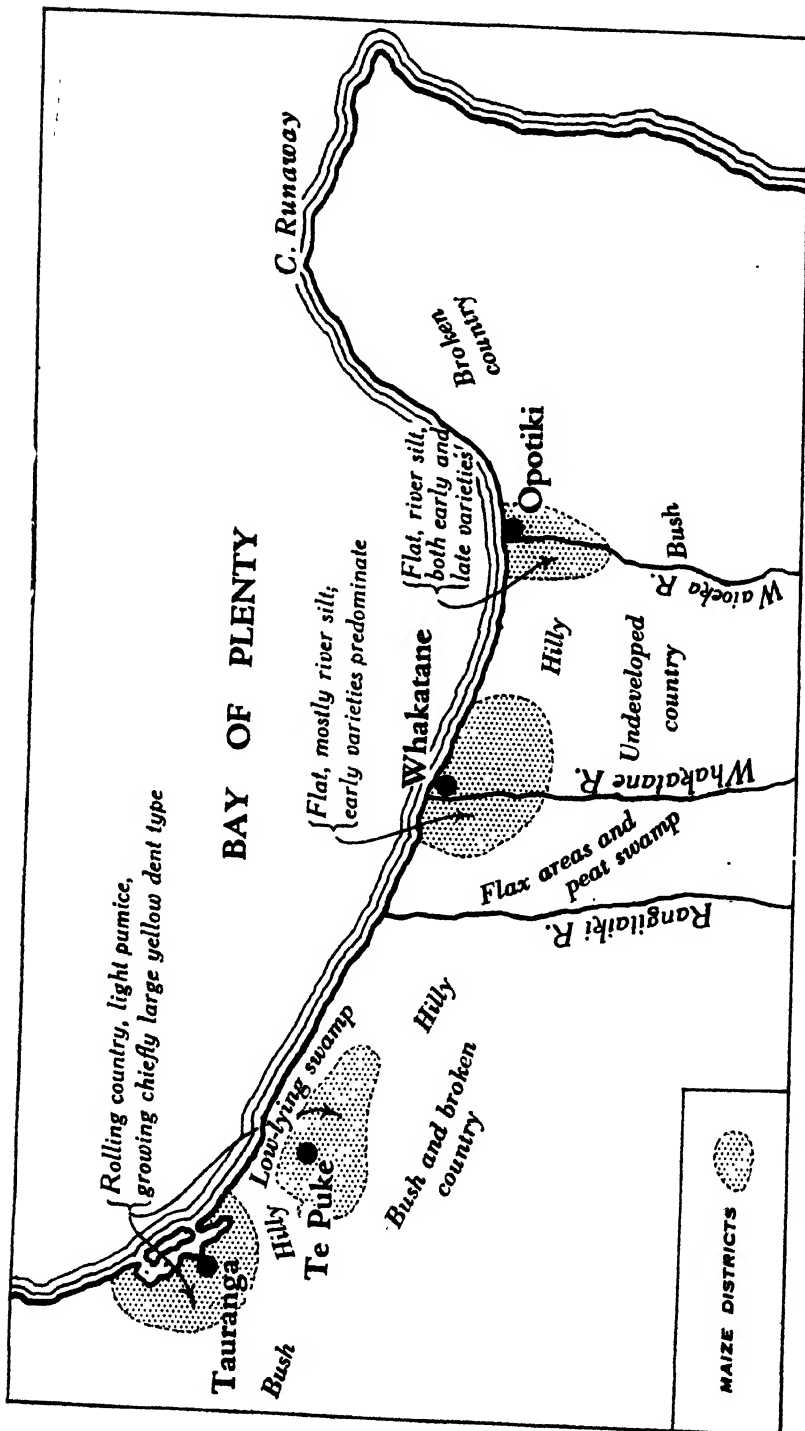


FIG. 1. SKETCH-MAP OF BAY OF PLENTY, INDICATING PRINCIPAL MAIZE-GROWING LOCALITIES AND NATURE OF COUNTRY.

Soil-conditions are therefore very varied in the maize belt, so that it is not possible to say that any particular soil-type is used in growing the crop. Undoubtedly, however, the most consistent results are obtained from the river-flats near Opotiki.

Climatic conditions throughout the maize districts vary to some extent with the soil-types. As would be expected, the lower country experiences heavier and more frequent frosts than does the higher hill country. Consequently it is found that the flats of Opotiki and Whakatane have a shorter growing season than does the hill country of Te Puke, Tauranga, and Opotiki. Moreover, the lighter soils are warmer and better drained, so that initial working can be done earlier in the season. This point is of considerable importance when selecting the variety to be grown in any district.

OTHER LOCAL POINTS.

Opotiki is generally regarded as the leading maize district, and has been the home of this crop for many years. Whakatane embraces a large area of comparatively new country which has not been devoted to maize, and the growers are more scattered than in the other localities.

So far as choice of varieties is concerned the Te Puke and Tauranga districts are practically identical, as both favour a rather slow-maturing type. There is, however, a difference in the method of planting generally adopted in each locality. Around Tauranga it is customary to plant on "the square," so as to allow of cultivation in two directions, whereas in Te Puke the usual method of continuous rows is adopted. There is a great deal in favour of the Tauranga system if annual weeds are troublesome, but with large areas it is not always practicable.

VARIETIES.

Speaking generally of the varieties in use in the Bay of Plenty, it can be said that these have become so intermixed that practically no varieties true to name are to be found. Originally pure varieties were introduced, but owing to these having been grown in neighbouring blocks, the identity of each was soon lost. At present there are only two distinct types grown. These are a late heavy-yielding type and an earlier lighter-yielding variety. Of the former it can be stated that very few strains are free from impurities, but with the latter there are several very satisfactory strains. This is no doubt due to the fact that the earlier varieties mature fully six weeks ahead of the late strains and so escape cross-pollination.

Late varieties in use are Horsetooth, Prairie Queen, and Hickory King. The first-named is the variety most generally grown. Prairie Queen is occasionally met with, but is obviously crossed with very late varieties. Hickory King is occasionally grown, but is more suited for green feed than for grain.

To instance the loss of identity suffered by a variety by crossing with others the Horsetooth maize can be taken. In this variety the grain should be long and narrow, resembling to some extent a horse's tooth, after which it has been named. But among the Horsetooth varieties grown and claimed to be true to type one often finds grain which is broad and shallow rather than characteristic of the variety.

There is obviously need, therefore, for better selection of seed in order to get back to the true type

Of the early varieties Early Butler is by far the most popular, and it is practically the only variety grown that has been kept reasonably pure. Other varieties occasionally met with are Early Red Leaming, and Funk's Yellow Dent

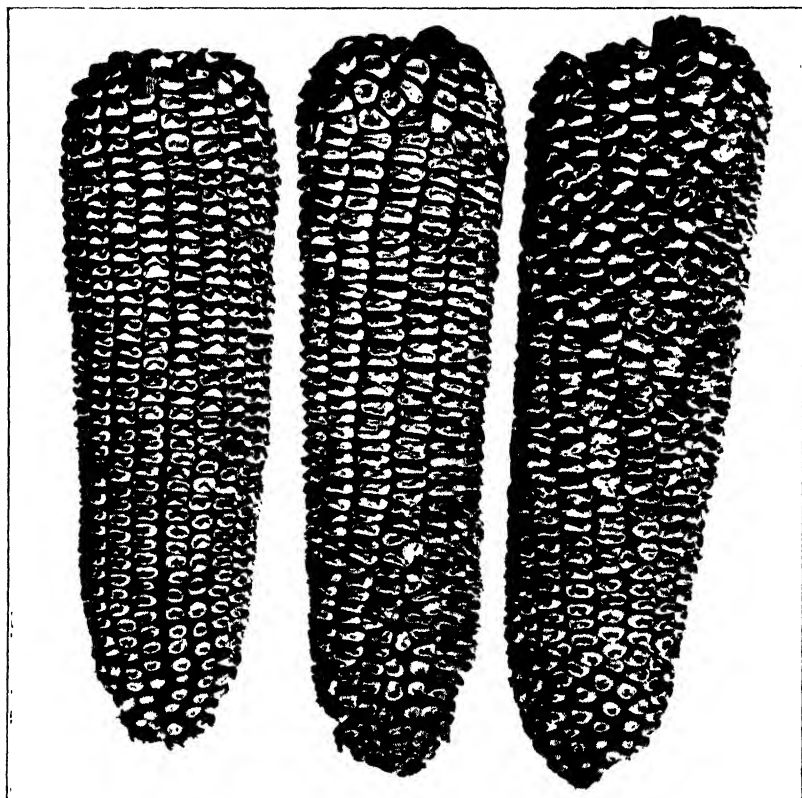


FIG. 2 HORSETOOTH MAIZE

Late-maturing variety suited to the heavier soils, where high yields (up to 100 bushels per acre) are obtained. Most strains are now crossed with Early Butler or Prairie Queen

[Photo by H. Drake.]

The improvement of varieties has been taken up by several progressive growers in the Bay of Plenty, and they have met with considerable success. As a result they have established a reputation for seed maize which has extended of recent years to the Gisborne district, where a great deal of maize is also grown.

PLACE OF MAIZE IN ROTATION.

In the early days maize-growing, particularly on the fertile river-flats at Opatiki, was repeated on the same areas year after year without

any apparent loss of fertility. Only such rich soils, however, could stand this treatment, as maize is a particularly heavy feeder. On the lighter soils such a practice would soon become unprofitable, and there is evidence that it has had a detrimental effect upon the land for years after maize-growing had ceased. Generally speaking, maize should be the first crop after grass. On heavier soils of high fertility a second successive crop may be taken without creating any ill effects, but on light soils this should be avoided as far as possible.

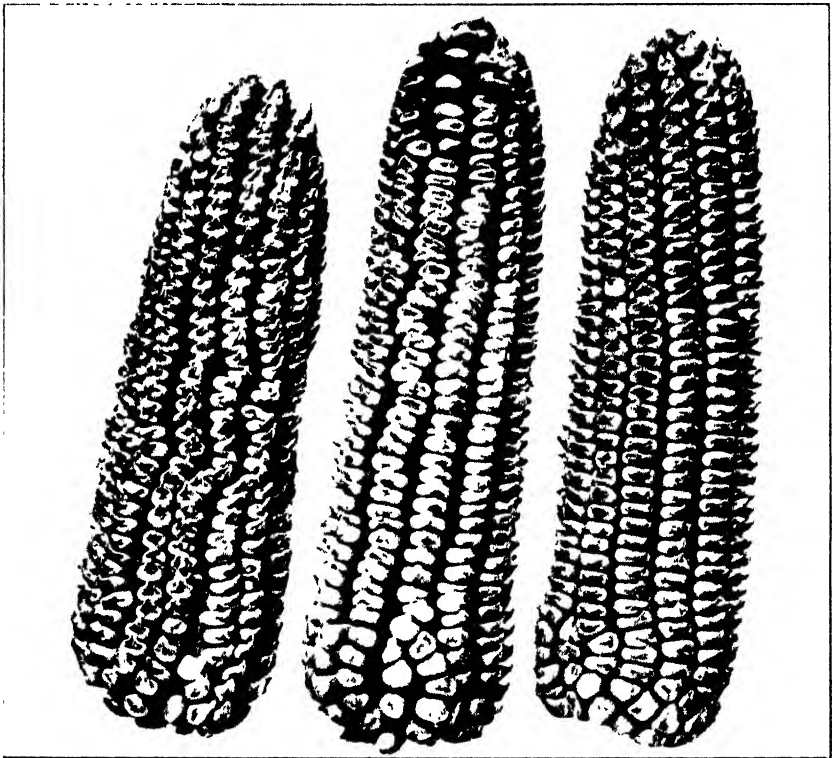


FIG. 3. EARLY BUTTER

Earliest-maturing variety, favoured on good soils where season is short, poor yielder on light country.

Photo by H. Drake.

Later in a rotation maize does not appear to do so well, as the crop appears to require first use of the humus ploughed in. On the light soils of the Tauranga district where it is desired to take a second and sometimes even a third crop it is the practice to sow lupins just prior to the last cultivation of the growing crop. After harvesting the crop these lupins are ploughed in, and they provide humus for the succeeding crop. This practice could well be exploited on all light soils, irrespective of whether a succeeding crop of maize is intended or not.

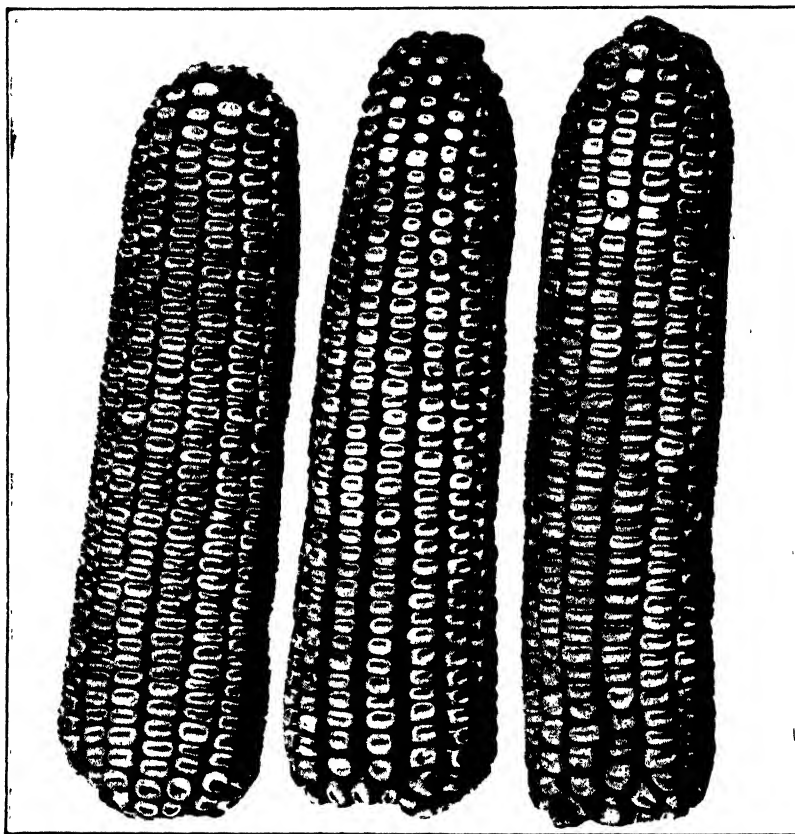


FIG. 4. EXCELSIOR.

Late-maturing variety, which does well on heavy soils. It has undergone more careful selection than any other existing strains in the Bay of Plenty.

Photo by H. Drake.

CULTIVATION.

The Bay of Plenty farmer in general does not pay sufficient attention to the cultivation of his maize area. The usual practice is to plough from six weeks to one week before sowing, work the soil at once with disks and harrows, and sow with a double-row planter. Usually the initial ploughing is left so late that one operation follows the other as rapidly as the farmer can carry them out. On the lighter soils the surface is sometimes rolled just before and immediately after sowing, but this is not a general practice.

The lateness of the initial ploughing on land previously in maize can be attributed to the fact that the farmer grazes the old maize-stalks through the winter and early spring. Too much value is often placed on these for that purpose, and if instead they were ploughed in after harvesting, and the land allowed to fallow, it is believed that more payable results would be obtained. To cut the stalks up

sufficiently to be ploughed in cleanly, a chopper-roller would be necessary, but in the absence of this ordinary disks would be fairly satisfactory.

SOWING.

The rate of seeding varies with the method of sowing. Usually 14 lb. to 16 lb. is required to sow an acre when a double-row planter is used. With some varieties it will be found that 12 lb. will suffice, but this depends upon the space between the rows. With the taller varieties it is usual to space the rows at 3 ft., with a single plant at

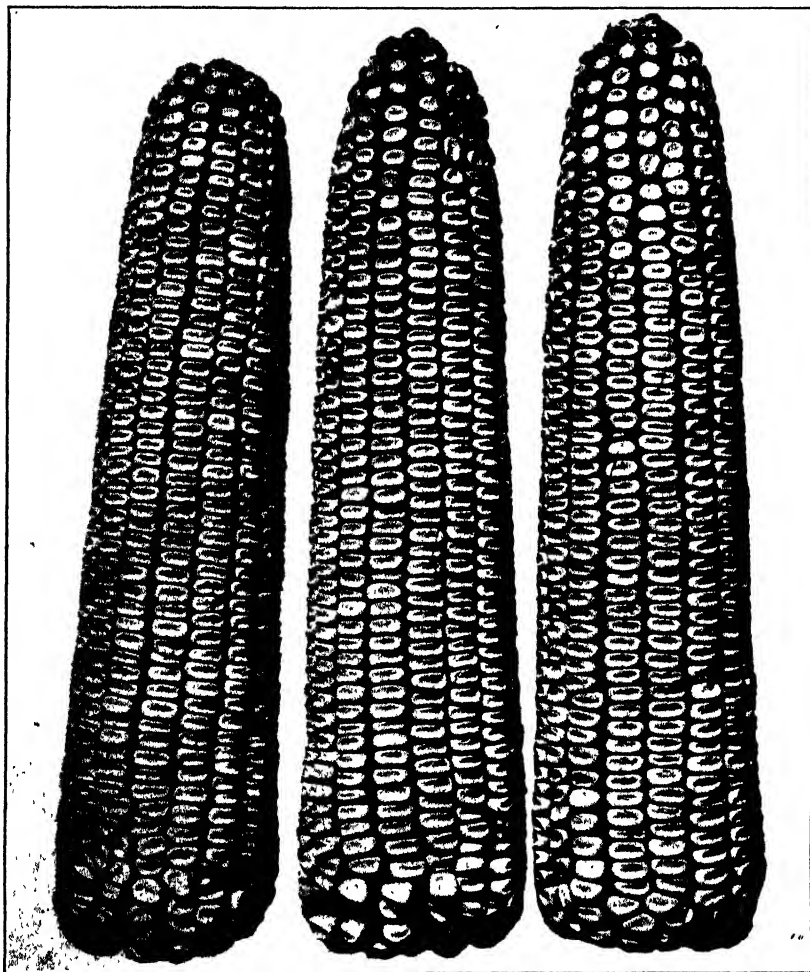


FIG 5 A LARGE YELLOW DENT.

Variety commonly grown in Tauranga and Te Puke localities

Late-maturing.

|Photo by H. Drake.

approximately every foot. Shorter varieties can be grown in rows 30 in. apart, so it can be seen that more seed would be required to sow an acre in this case than with the taller varieties.

Where seed is sown by hand and on "the square," as in Tauranga, 10 lb. to 12 lb. is quite sufficient. The method of setting out the field for this work is as follows. A sledge with three runners spaced at 3 ft. intervals is drawn across the field in one direction until the whole area is covered. It is then drawn at right angles across the field, and at each point where the impressions of the runners intersect seed is dibbled in. Special hand-sowers are provided for this work, and it is estimated that a man can cover 4 acres in this way in a day.

MANURING.

Since the double-row planter has been in use it has been the practice to sow the manure with the seed at the maximum rate provided by this machine. Most of these implements are capable of a maximum of 3 cwt. to 4 cwt. per acre, so that this figure has come to be generally regarded as the quantity to be sown with the maize crop. Practically without exception this has been entirely super-phosphate until recently, when special maize-manures containing in addition some nitrogen and potash have found favour.

One must bear in mind the special green-manuring adopted in the Tauranga area by the ploughing-in of lupins. This is undoubtedly a great help to the succeeding crop, whether it be maize or any other.

INTERCULTIVATION

Intercultivation commences in some cases before the crop shows above the ground. Farmers on the lighter soils have to contend with rapid growth of spring weeds, and therefore many harrow the field a few days after sowing. This harrowing is usually a very light one. Later, when the young maize-plants are a few inches high, a further harrowing is given. This does not destroy as many plants as one would perhaps expect, but it certainly checks incipient weed-growth. It is usual to select a warm day for this work, as less damage is then done to the maize-plants than would be the case in cold weather.

As the plants grow stronger and when they are about 6 in. to 9 in. high the first scarifying is given. This is usually deep, as the roots of the plants have not by then spread very far outwards. Later, further scarifyings are given at intervals of two weeks, until the crop is too tall to cultivate without damaging the plants unnecessarily. These later scarifyings require to be done to a shallower level on account of the maize-roots spreading across the rows a few inches below the surface.

It is usual for a crop to receive six to eight scarifyings during a season, but many receive less than this number. Such crops are easily detected by the stunted nature of the maize and the rank growth of weeds.

HARVESTING.

The ripened crop is allowed to stand in the field until mid-winter. Once the grain has ripened and hardened off it is considered

advantageous to allow the crop to experience several winter frosts before harvesting. No damage is done to the grain then, and it is claimed that its quality is improved.

The actual harvesting is done by hand, the cobs being plucked from the stems by the farmer himself or by contract labour. It is usual where the area is extensive to let a contract to Maoris for the plucking and bagging of the cobs. Cartage to the maize cribs is done in most cases by the farmer himself. The cost of harvesting when done by contract varies in different districts from 30s. to 45s. per acre. The higher rate generally rules for crops of Early Butler, which is rather severe on the hands.

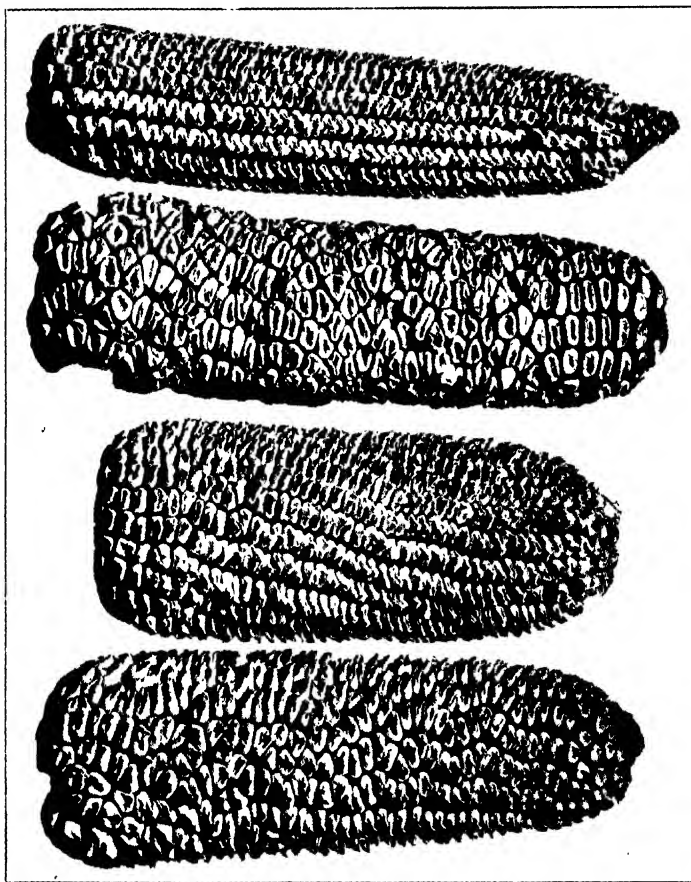


FIG. 6. MIXED TYPES, SHOWING NEED FOR SEED-SELECTION.

These cobs were taken from one crop, and represent only a few of the types which were to be seen in it.

(Photo by H. Drake.

SELECTION OF SEED.

Each year it is customary for the growers to select their seed maize as the cobs come from the shed to the sheller. Usually all the largest cobs are set aside for seed, and in doing so the farmer has no knowledge whatever of the conditions under which these cobs were produced. This is regularly reflected in the motley appearance of many of the crops, showing as they do irregularity in maturity, height, shape of cob, and type of grain.

Undoubtedly more care should be exercised, and if the farmer cannot spare sufficient time for field selection he should purchase seed from some reputable grower. There seems to be some objection to this owing to the cost of seed maize, but the farmer who objects to an outlay of 4s. per acre on seed maize will very often spend £2 per acre on oats for seed.

Where a reasonably good strain is held it would pay the farmer handsomely to select all his seed from the crop before harvesting. He is then in a position to select for uniformity of ripening, and will know that each cob was growing under ordinary field conditions. Such seed can be relied on to give more uniform results than does the seed selected in the old obsolete way from the crib.

YIELDS AND USES OF THE CROP.

Perhaps the greatest influence on the yield of maize crops in the Bay of Plenty is the position of the crop in the rotation. Where the land was previously in maize the yield is almost invariably lower than for the first crop, and on light soils this is very much more marked than on the heavier soil-types. Usually in the Opotiki area a yield of 60 bushels per acre is considered good, although yields of 80 bushels and more are not uncommon. Similar yields would be expected in the better parts of the Whakatane area, but around Te Puke and Tauranga, 50 bushels, with occasional yields in excess of 70 bushels, per acre would be the average.

At present about two-thirds of the maize produced on the farms is sold, and finds its way to suburban poultrymen and to pig-raisers in the Waikato. Of the rest retained on the farm, poultry, pigs, and horses are the chief consumers. Occasionally one meets a settler who grinds his own grain for calf-meal, but such cases are rare. This, however, is a direction in which the use of maize could perhaps be exploited to a greater extent.

CONCLUSION.

In concluding it may be said that, while maize-growing may still be a remunerative line of farming in the Bay of Plenty district, there are several directions in which improvements appear possible in the method of growing the crop, and the adoption of such methods should lead to an improvement in yields. Firstly, greater care should be exercised in selecting the seed; then better preparation of the soil for the crop should be given, and, as suggested, this might take the form of a winter fallow; finally, more careful selection of varieties according to climatic and soil conditions would be beneficial to the growers. Only by a combination of all such improvements in the growing of the crop can it be expected to give its maximum return.

FROST-PREVENTION FOR ORCHARDS.

EXPERIMENTS AND EXPERIENCES IN CENTRAL OTAGO. SEASON 1928-29.

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SEASONAL CONDITIONS.

THE spring of 1928 in Central Otago was not a notably bad one so far as damaging frosts were concerned, though the district experienced some cold snaps as usual. The 8th and 9th September were bitterly cold, with snow falling on the ranges, and on the latter day there was sleet on the flats. The following morning there was a frost which did a certain amount of injury in a few low-lying spots. Apricots were then blooming freely, and it is probable that a considerable number of blossoms were damaged through the cold snap interfering with the work of bees. Following a cold spell, with several falls of snow on the ranges, frosts occurred on the mornings of 28th and 29th September. October opened warm, but another spell of cold weather, with snow falling on the high country, occurred, culminating in a light frost on the morning of the 16th. Again on the morning of 10th November there was a frost, preceded by falls of snow on the ranges. The frost alarm rang on each of these four occasions.

Field Tests at Alexandra.

Field experiments were continued during the spring of 1928 at the orchard of Mr. W. Bringans, Alexandra. Owing to illness Mr. Bringans was in hospital early in September, and therefore the firepots were not put out in the orchard until the 25th of that month. The previous cold snap of the 8th and 9th did considerable damage to his apricot-blossoms, which resulted in a light crop of this fruit.

The condition of the blossoms at this orchard on 17th September was as follows:—Apricots: Blossoms nearly all fallen; a few late ones still out. Peaches and nectarines: Full pink to one-third out. Cherry-plums: Commencing to fall. Plums: Mostly approaching open cluster. One variety of Japanese in full bloom. Cherries: Open cluster. Pears: Green tip to tight cluster. Apples: Green tip to tight cluster. Quinces: Foliage out, but no blossoms showing.

An endeavour will be made in the future to annually collect definite data regarding the blossoming-periods of the chief varieties of each class of fruit in this district. Such information, together with the amount of frost injury sustained, should greatly assist in ascertaining the more susceptible varieties and the degree of frost they will stand at various stages.

The area under protection was increased, by co-operation with Mr. Bringans, to $4\frac{1}{2}$ acres, and consisted of all classes of stone-fruit. On this area 380 firepots were laid out in the same manner as described in the *Journal* for June, 1928.

On the morning of 28th September the alarm rang at 2.5 a.m., and at 2.30 a.m. the lowest temperature was 28.5° F. There followed a slight rise, and an hour later it was one-half to one and a half degrees

higher, according to the position of the thermometers. Soon after there was a fall, and alternate firepots (a total of 221) were lit at 4 a.m., the temperature being then 27° F. By 1.45 a.m. the temperature outside the experimental area was 28.2° , while inside we had raised it in the coldest spot to 30° , and the highest reading was 31.5° . The weather was calm, and until now the drift had been from the north; it then changed to south-east, to north-east, to east, and by 5.30 a.m. it was back to south-east, when the outside temperature was 28.8° , and the inside from 29.8° in the south-west corner to 31° in the north-east (the lee side). Throughout there had been a few clouds from the south to the north-east, the sun, which rose above the hill at about 5.45 a.m., being obscured until 6.30 a.m. At 6 a.m. the temperatures were practically the same as at the previous reading, with the drift from the north-west. When the sun appeared above the clouds the drift was from the north-east, and the temperature 31.2° outside and 32° to 33° inside the area. All fires were then immediately extinguished. With an average of only fifty firepots lit per acre the temperature was raised two to three degrees. The standard minimum temperatures for that night recorded at the Alexandra Climatological Station were 30° in the Stevenson screen at 4 ft. 6 in. level, and 20° exposed on the grass, whereas the lowest recorded under an ordinary shelter at the 4 ft. 6 in. level in the orchard was 27° .

The alarm again rang the following morning at 1.40 a.m., the previous day having been fine and sunny. At 2.20 a.m. the temperature had fallen, the lowest reading then being 26.5° , and 192 firepots were immediately lit over an area of about $3\frac{1}{2}$ acres. By 2.55 a.m. the outside temperature was 26.8° , and varied inside from 28.8° to 29.6° . At 3.20 a.m. it was 27° outside and 29.1° to 30.2° inside. By 5.35 a.m. the outside temperature had risen to 28.8° , and inside it varied from 30° to 31° . The sun rose soon after, and all fires were extinguished. The weather was calm with an easterly drift most of the time, but with occasional changes all round the compass. The sky showed thin clouds around the east, south, and west most of the night. On this occasion again it will be seen that the temperature was raised with an average of fifty-five firepots lighted per acre. The standard minimum temperature recorded at the Alexandra Climatological Station was 29.7° in screen at 4 ft. 6 in. level, and 19.5° exposed on the grass, the lowest in the orchard, under an ordinary shelter at 4 ft. 6 in., being 26.5° .

On 16th October the alarm rang at 4 a.m., the temperature twenty minutes later being 29° . As the temperature gradually rose it was not considered necessary to light up, and by 5.20 a.m. the readings were all above freezing-point.

The alarm also rang at 4 a.m. on 10th November. The temperature remained at freezing-point for a very short while and then rose, thus obviating the necessity of lighting up.

It should be noted that all times given in this article are mean time and not "daylight-saving."

FROST-ALARM AND THERMOMETERS.

The alarm (Tycos) was erected at my home, and a number of experiments were carried out whenever there were frosts in the early

mornings in August. The idea was to ascertain at what height the alarm thermometer should be placed. At 4 ft. 6 in. from the ground (the standard level) the greatest variation from a thermometer placed under the ordinary shelter at the same height and in close proximity was 0.2° . At Mr. Bringans's, therefore, it was placed at this height in a much more exposed position than it had been in the preceding year's experiments, and proved quite satisfactory. Each grower must find out the correct height for himself by placing the alarm at such a height above the ground as to cause it to ring when the temperature in the coldest part of his orchard reaches about 32° under an ordinary shelter at 4 ft. 6 in. from the ground.

All thermometers were tested prior to the experiments. The stems were placed in ice and water in a bucket, and each thermometer marked with any variation it showed from 32° F. The greatest error only proved to be 0.2° at that temperature.

Experience with Apricots at Earnsclough.

I am indebted to Mr. J. R. Laing, of Earnsclough, for particulars regarding his heating operations last spring. Preparations had been made for protecting his fruit crops (stone and pip) on a large scale, but the areas which needed heat were only two small separate blocks of apricots totalling 2 acres in extent. On these were distributed 150 firepots on lines previously suggested by me. On the morning of 28th September, the Tycos frost-alarm rang at 2.40 a.m. (over half an hour later than at Mr. Bringans's). At 2.50 a.m., with the temperature at 28° F., Mr. Laing commenced to light up—first all around the outside, and then alternate pots inside, completing at 3.30 a.m. At 4 a.m. the temperature had dropped to 27° outside the areas, and inside it had risen to 32° F., there being a south-west drift. At 4.45 a.m. the outside thermometers registered 28° , and at 5.10 a.m. 32° , while inside the areas the temperatures ranged from 32° to 33° . At this time there were heavy clouds in the east, some of which would probably be accounted for by the orchard fires at Mr. Bringans's. A sudden drop outside to 28° occurred at 5.55 a.m., and inside the temperature decreased to 30° . Lights were extinguished at 6.30 a.m., when the sun had risen above the clouds.

That night the alarm rang at 11.45. At 1.15 a.m. (29th) the temperature was 28° . Alternate firepots were then lit, the operation being completed by 1.40. The temperature at 1.50 was 30° , with no air-drift but clouds appearing in the north-west. At 2.50 the temperature outside was 29° , and inside 31° ; the sky was clouding over and the drift was from the north-west. At 4 a.m. the rest of the firepots round the outside were lighted, and at 4.45 all heaters in these areas were alight, the thermometers registering 29° outside and 31° inside. Mr. Laing commenced extinguishing the fires at 5.30 and completed the operation at 6 a.m.

A minor frost occurred on the morning of 16th October, when the heaters were lit for two hours. The temperature varied from 28° to 31° outside, and did not drop below 31° inside the heated areas.

It will be seen, therefore, that Mr. Laing, during the three firings, consistently raised the temperature from two to five degrees, and thus

saved his crop, for no damage occurred to the apricots in what are considered very susceptible blocks, and a full crop, the only good one for some years, was harvested. Approximately two barrels of oil were used in each of the first two heatings, and one barrel in the third one.

Protection of Tomatoes at Earnsclough.

Mr. W. H. Hinton, of Earnsclough, has kindly furnished me with data concerning the protection of eight thousand tomato-plants in the past autumn. A heavy crop still remained in mid-March, so he placed 250 firepots among them. There were fifty rows of approximately one hundred and fifty plants in each, the rows being 3 ft. 6 in. apart. Down each alternate row ten pots were placed at even distances. Three standard minimum thermometers were placed 1 ft. from the ground on boxes—one near each end of the plot and one in the centre. The alarm thermometer was situated 3 ft. from the ground on a post in the lowest spot in the area, and connected with the batteries and bell in Mr. Hinton's bedroom.

The first call was received at 2 a.m. on 1st April, the alarm thermometer registering 31° F. and those in the plot 31.5° (top end), 31.5° (centre), and 30.5° (bottom end). Mr. Hinton's idea was to wait until four degrees of frost was registered on any one of the thermometers. To test what one man could do he refrained from calling up any one else, and while waiting he took off the lids. The danger-point was reached at 5.30 a.m., when he ignited his torch and immediately lit the outside pots all round, then alternate pots in each alternate row. One hundred and thirty pots were thus alight within twelve minutes. Within a very short space of time the centre thermometer rose three degrees—namely, from 29° to 32° . The end thermometers did not register such a rise except when the drift was in their direction. The temperature was held in the centre of the plot until 6.30 a.m. (half an hour before sunrise—the coldest time) when it was thought advisable to completely fire alternate rows, making an extra sixty pots, or 190 in all. This was found to be sufficient to keep the temperature not lower than 29° , while the lowest outside the heated area was 26° . As a check thirty plants in a sheltered spot against the wall of the house were left unprotected, and these were distinctly frosted, whereas those in the heated area were almost untouched, only a few around the outside being slightly nipped. This frost did very heavy damage to tomato crops around the district where they were not protected. The air-drift was from all quarters, and carried the heat first in one direction and then in another, with the result that ice formed rapidly on the outside rows until such time as the drift changed—the matter generally of only a few minutes. Although ice was thus formed it never remained long enough to penetrate the fruit—therefore causing practically no damage. Mr. Hinton noted that when the pots were alight the cold air rushed in from both ends. The rows of plants—5 ft. high—acted as a funnel and carried the heat away too quickly into the air. Probably on this account more pots had to be lit than should otherwise have been necessary. To overcome this difficulty he put up a scrim shelter 6 ft. high at each end for subsequent heatings.

The next severe frost occurred a fortnight later, by which time another 250 cases of the crop had been harvested. The erection of the scrim shelters at each end proved very successful. With the same amount of frost as on the previous occasion—namely, six degrees—the lowest temperature recorded on the centre thermometer was only two degrees of frost, as against three degrees without the scrim.

There was another frost a week later when nine degrees of frost was registered outside and a minimum of two to five degrees inside the heated area. The latter figure was only touched for a very short period just before sunrise, the temperature most of the time being 29° and 30°. All the firepots were lit for three hours, and only slight damage was done. This was undoubtedly a very fine save; no doubt the holding of the temperature for most of the time at not lower than 29° and 30° was the great factor. Had the temperature been allowed to fall to 29°, or below for any lengthened period, and then followed by a sudden drop, considerable damage must have occurred.

The prospects were for heavier and nightly frosts, so the plants were stripped and a heavy crop gathered and stored, as it was considered there would be no further gain by protecting them. It may be noted here that although the firepots were only 1 ft. away from the plants these did not suffer scorching.

If comparisons are made between the protection of fruit-trees and tomatoes it must be remembered that the latter are a ground crop. If readers will refer back to my previous series of articles on frost-prevention they will find considerable reference to "temperature inversion"—in ordinary parlance, the phenomenon of the frost being heavier near the ground than it is, say, some feet higher up. For these reasons the alarm thermometer was placed for tomatoes at 3 ft. from the ground, and the other thermometers only 1 ft. above ground-level. In the protection of fruit-trees against frost all thermometers are placed on the 4 ft. 6 in. level.

Future Prospects and Investigation.

That this system of protecting orchards and garden crops from frost injury is likely to become a permanent feature in orchard operations among the better growers of Central Otago who suffer such losses appears more than likely. Two years ago no provision of any kind was made; last season there was sufficient apparatus in the district to protect about 44 acres, made up as follows, the number of firepots being given in parentheses: J. R. Laing, 16 acres (1,000); W. H. Hinton, 15 acres (900); W. Bringans, 5 acres (380); C. McIntosh, 2½ acres (200); J. R. Forrest, 2½ acres (200); E. Goodall, 1 acre (100); M. P. McGinnis, 1 acre (100); R. Kinnaird, 1 acre (100). This represents protection for about six thousand trees.

All growers interested in protecting their orchards from frost injury would be well advised to become regular subscribers to this *Journal*, and to procure back numbers for June, July, and August, 1928, in which were published a series of illustrated articles on "Frost-prevention for Orchards," covering experiments carried out, costs, suggestions, &c.

At present, unless strong arguments are induced in favour, I am not prepared to recommend a continuance of the experiments in their present form but rather to consolidate the experience already gained. As noted above, a number of growers have now the necessary apparatus, and I am inclined to think that more good can be done by keeping in touch with these men, assisting them with advice, helping them in their operations, and watching and noting the results obtained.

The smoke-bombs for creating a smoke screen against the rising sun, which were forwarded to me, are still on hand, a favourable opportunity for trying them not yet having occurred. For a successful trial very careful thought and management will be necessary to obtain accurate results. The thermostat alarm will also require testing as opportunity occurs, for a suitable trial could not be arranged last season.

ALEXANDRA CLIMATOLOGICAL STATION

The establishment of this station under the Dominion Meteorological Office, which was forecasted in a former article, is now an accomplished fact. Through the co-operation of the Alexandra Borough Council, who supplied a plot in the recreation reserve rent-free, the Central Otago Fruitgrowers' Association, who purchased and erected the fencing; the Meteorological Office, who supplied the instruments; and the Public Works Department, whose officer (Mr. George Smith) records the readings twice daily, a station of a high order has been established. From the viewpoint of frost-prevention the information thus gathered will prove invaluable in supplying records of temperatures, ascertaining conditions conducive to frost, and forecasting frosts and the degree of severity anticipated.

I desire again to acknowledge the assistance afforded me by Mr. Bringans, his family, and many others, which conduced to the undoubted success of the experiments. My thanks are also due to Messrs. Laing and Hinton for the interesting material supplied regarding their own experiences, which is embodied in this article.

Wool-branding Fluids. During the past official year some further samples of wool-branding fluids on the market were examined at the Agriculture Department's Chemical Laboratory. No tarry matter or other harmful ingredients were detected.

Casein Manufacture and Grading. The quantity of casein graded for export by the Dairy Division during the year ended 31st March, 1929, was slightly less than for the preceding twelve months, the figures being 1,890 tons and 2,233 tons respectively. Approximately 80 per cent. of this total consisted of lactic casein, the balance of 20 per cent. being of the rennet variety. Quality was of a very high standard. During the year a plant for drying casein was established at Midhurst, in Taranaki, the finished article being graded and shipped at New Plymouth. In addition the grading of casein is carried out at Castlecliff and Auckland. The grading of casein is optional, but at the request of manufacturers it has been the practice of the Dairy Division to grade all lines offering for shipment. No fee was charged in the past for this service, but during the year it was decided, in order to bring the grading into line with that of butter and cheese, to charge a grading fee of 1½d. per hundredweight, and this came into operation as from 1st February last.

ENSILAGE ON THE FARM.

METHODS OF MAKING AND HANDLING

J. W. DEEM, Director of the Fields Division

GENERAL CONSIDERATIONS.

THE making of ensilage should be an important feature in the farm-work of a great many districts of New Zealand, but especially in those where the weather is tricky and the making of good hay is a doubtful undertaking and a source of worry to the farmer. Even in districts where fairly good hay can be made it would be a better paying proposition to turn a portion of the available hay material into silage. Ensilage has this great advantage over hay, that it can be made just when the material is ready. Weather conditions do not interfere to any great extent, as, unless it is actually raining hard, the work need not be held up, showery weather is not hurtful, except that it increases the weight of the material to be handled.

Ensilage has the further advantage over hay that a great deal of rough material, such as coarse grasses, thistles, &c, which would not make palatable hay, will make fairly good useful silage, as the process of curing softens the hard stems and makes the material edible. At the same time it must be pointed out that poor material will not make the best ensilage, as with other crops, the better the material the better the results. A good stack or pit of ensilage is the best insurance policy a dairy-farmer can have on his farm. If not required at once it will keep for several years when properly made.

Ensilage will be found invaluable for all classes of stock, but especially for dairy cows, to take the place of roots and hay during the autumn, winter, and spring. For feeding to cows a month or two before calving it cannot be excelled. Experiments show that cows fed on good ensilage will give almost if not quite as good a return as when fed on the best of roots and green fodders. Cows fed on ensilage have a mellow appearance as compared with those fed on hay. Their skins are softer and looser, they calve and clean up better, and come to profit quicker.

An objection to ensilage is the cost of handling the mass of green material as compared with cured hay. If, however, a mechanical stacker is used for hoisting, and sweeps or sledges employed for carting the material to the stack, the labour is greatly minimized; in fact, under these conditions it would often be less than that necessary to make hay. The material would be saved at its best and the worry of haymaking eliminated. It must be recognized that a great deal of the so-called hay saved in many parts of New Zealand has been so spoiled by the weather that by the time it reaches the stack it is little if any better than badly saved wheat-straw.

MATERIALS FOR ENSILAGE.

Having decided that it is good farming practice to make ensilage, the next consideration is the best material to use.

Good pasture-growth of grasses and clovers mixed in fairly even proportions is hard to excel, and if properly saved the resultant silage

is almost perfect. Among the special crops, oats, wheat, barley, maize, and millet or sorghum, in conjunction with tares or peas, make about the best combinations. Any of the cereals, maize, millet, or sorghum will make good ensilage by themselves, but the addition of tares or peas increases the protein content and a better balanced ration is produced.

Lucerne also makes good ensilage, but being very rich in protein it is better mixed with grass, millet, or maize to make a more balanced fodder. Lucerne-growers frequently find a difficulty in disposing of the first cutting from a field in the spring. As this cutting generally contains a good deal of foreign matter in the shape of grass, weeds, &c., it makes good ensilage without the addition of other mixtures, and there is no better way of dealing with it.

On a great many farms there is a surplus of grass towards the end of November. This can with great advantage be cut and made into ensilage. Besides producing a quantity of good silage the removal of this grass will greatly benefit the pasture by allowing the clovers and finer grasses to come away and form a dense green covering.

Of the special crops, temporary pasture consisting of Italian rye-grass (20 lb. per acre) and red clover (6 lb.), and wheat or oats (2 bushels), in conjunction with tares or peas (1 bushel) are probably the best. The wheat or oats and tares may be sown in the autumn, fed off during the winter and spring, and then allowed to run for a crop, being ready for cutting early in December. Peas are first-class for spring sowing, but do not stand the winter and feeding if sown in the autumn. A mixture of peas (1 bushel) and beans (2 bushels) is also a good ensilage crop, likewise millet (16 lb.) or maize (2 bushels), but, as already mentioned, millet or maize is better when mixed with a legume like lucerne or peas. Peas may be grown in conjunction with either millet or maize, or an area of one of the latter crops and an area of peas grown separately and mixed when stacking. This usually gives the heaviest crops.

As in the making of good hay, material for ensilage should be cut at the right time if first-class silage is desired. Mixed grasses should be cut when the predominating varieties are in bloom; cereals just when the grain is thickening from the milk to the dough stage, maize when the cobs are taking on a glazed appearance, and peas and tares between the blooming and early podding stages.

METHODS OF ENSILAGE-MAKING.

There are three main methods of making ensilage---the silo, the pit and/or trench, and the stack.

The Silo.

The silo has many advantages, especially if it can be erected in a central position so as to minimize the carting of green material. It should be fitted with a cutter and blower or elevator for economy in filling. It is better to have two medium-sized silos than one large one. This enables the farmer to be filling one while the other is being used, which is a great advantage where silage is being used for summer feeding, and when small quantities of material are available from time to time. If possible a site should be chosen where a fair depth of the silo may be let into a bank. This secures economy in erection and in subsequent hoisting of material.

The Pit or Trench.

Where suitable banks are to be had in handy positions the pit is a very fine method of making ensilage, and frequently one can be provided in each field or where it will serve two or three paddocks. In choosing the site for a pit care should be taken to see that it can be conveniently filled from above, and that good access can be had from the front of the pit for carting out the material. The site should also be free from the danger of ground-water seeping into the pit. A round pit is much better than a square one, as it is difficult to fill the corners satisfactorily in the latter so as to exclude the air, and there is generally considerable loss from this cause. The walls should have a slight batter, 1 in 15 being about right. The opening to a round pit should if possible be just wide enough to allow a dray to

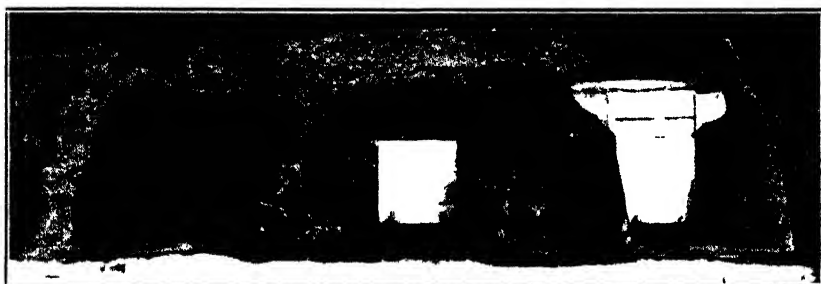


FIG. 1. MODELS OF DIFFERENT TYPES OF PIT.

On left square pit (undesirable type), centre ordinary round pit for temporary use, right permanent round pit, with shoulders reinforced and concrete ring on top to extend capacity and carry roof.

back in, and where the pit is to be permanent the corners of the opening should be cemented so as to carry timber to close the opening as the pit is being filled. In the case of a temporary pit a good stout post may be placed at these corners. The timber for closing the opening should not be less than 2 in. stuff. In filling a pit great care should be taken to see that it is evenly filled and that the sides are well tramped, so that there is no possible chance of the material losing contact with the walls and admitting air. The same precautions are necessary in filling the pit as in building a stack to ensure that the temperature is properly controlled.

The approximate holding-capacity of round pits or silos of different sizes is as follows:—

Height (Feet).	Diameter (Feet).	Capacity (Tons).
20	10	30
20	12	45
24	12	55
20	14	60
30	12	75
30	14	100

Within reason, height should be sought in ensilage pits and stacks. An unduly shallow pit or low stack means an increase in the amount of surface for a given volume of material, with a corresponding increase in wastage; more weighting-material is also required to be placed on the top of the stack.



FIG. 2 IDEAL SITUATION FOR ENSILAGE-PIT

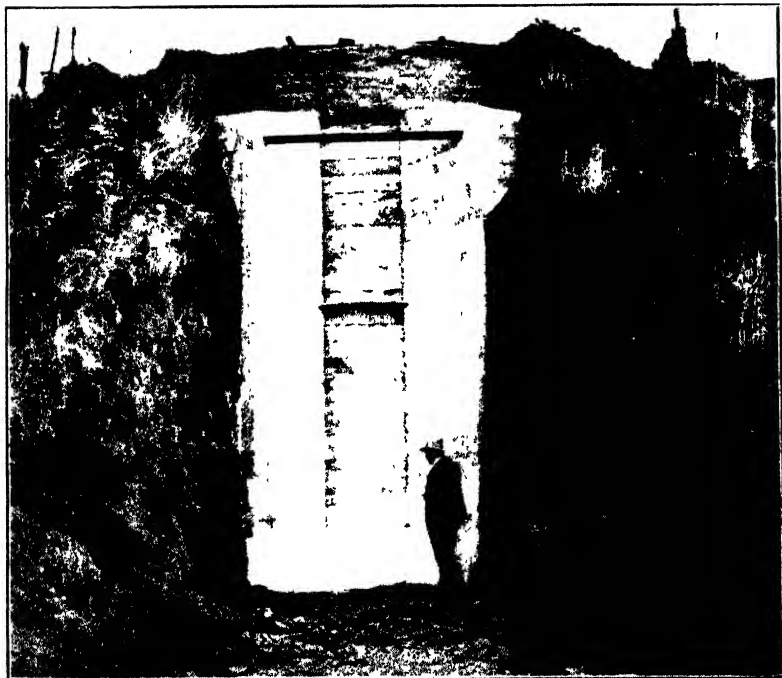


FIG 3 PIT WITH CONCRETE FACINGS AND TOP, SITUATED AS SHOWN IN FIG. 2.

Trench pits for ensilage are frequently dug on the level, a spot being selected with just sufficient fall to prevent surface water running in. This method is used very extensively in Australia. A trench 60 ft. long, 21 ft. wide, and 6 ft. deep will hold approximately 100 tons of silage. Excavating is usually done by means of a plough and scoop. The ends of the trench should have a batter of 1 in 1 to allow of easy filling and emptying by driving right through.

A modification of this system is largely practised in the Waikato district, and the following description is supplied by Mr. P. W. Smallfield, Fields Superintendent, Auckland :—

The pit is dug in from the edge of a low hill and made with rounded corners to facilitate the packing of the silage. The pit illustrated in the diagrams (Figs 4 to 47) is 33 ft. long by 14 ft. wide by 8 ft. deep. The batter on the sides is 1 in 8, but more batter may be required on soils that are liable to slip. The depth of the pit will depend on the height of the permanent water-level in the locality, and the bottom must be above this level. In some soils pits can safely be made 10 ft. to 15 ft. or more deep. The bottom of the pit is sloped outwards to give drainage, and in the centre is a concrete roadway running up two-thirds of the length of the pit to allow of the carting out of silage during wet weather.

The turf and soil taken from the top of the pit during digging operations should be used to build up the surface of the land at the edges of the pit, so that rain water from the hillside will not run in, and to level the ground all round the pit to facilitate filling operations.

The entrance to the pit is boarded up to prevent the silage stacked in the pit creeping away from the sides. When silage creeps away from the walls air enters and a layer of waste occurs round the sides of the pit. The entrance is boarded up by means of 6 in. by 2 in. planks carried 4 ft. or 5 ft. above the ground-level. The planks are placed against three 4 in. by 4 in. posts, which are sunk in concrete. Behind and at the sides of the two end posts a thin mixture of concrete should be run in between the posts and the earth wall, so that the back of the posts is tightly packed. Each end post carries a 4 in. by 1 in. batten to which is fixed a piece of 2 in. by 1 in., so as to make a slot, down which the 6 in. by 2 in. planks can be dropped and kept in position while the pit is being filled. The centre post is fitted loosely into a hole lined with concrete, and can be removed when the pit is being emptied. When the post is removed and carting operations are in progress the post-hole is covered by a piece of board (6 in. by 6 in. by 2 in.) which fits in a groove at the top of the hole. The tops of the three beams are held together by a 4 in. by 4 in. beam fastened to the posts by means of carriage-bolts. The three posts are stayed by 4 in. by 4 in. struts, the centre post by a strut supported in a slot in the concrete floor and fastened to the centre post by a carriage-bolt, and the side posts by struts fixed in the bank wall.

The Stack.

On the average farm the stack system will probably be the one followed by a majority of farmers for a long time to come. Its great recommendation is that the stack may be built in any field where the material is grown, which means a great saving of haulage.

In building an ensilage-stack it is very important that the farmer should have a fair idea of the quantity of material he has to put into it and the size of the stack required. The following figures will be useful: A good average crop of meadow hay will provide about 7 tons of green material per acre; a fair crop of lucerne or temporary pasture

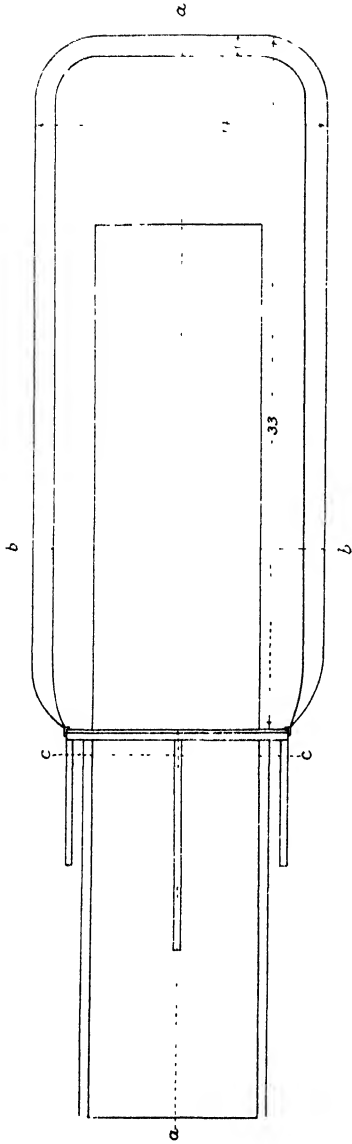


FIG 4 PLAN OF PIT TO HOLD 60-05 TONS OF SILAGE.

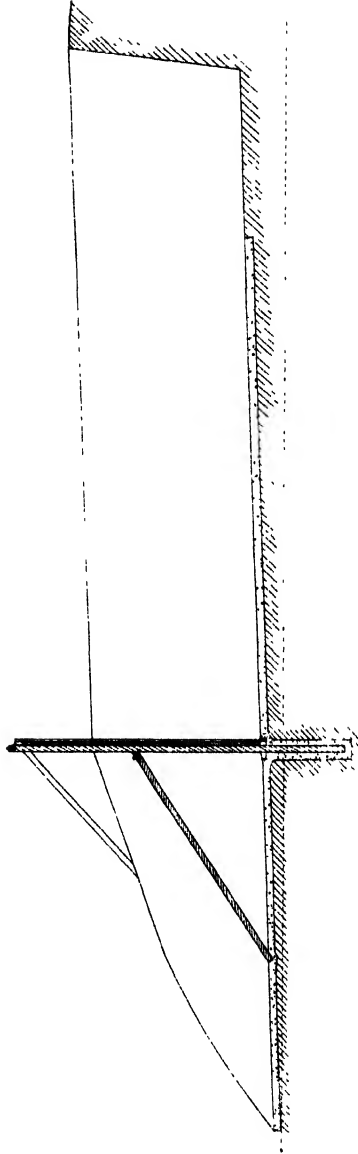
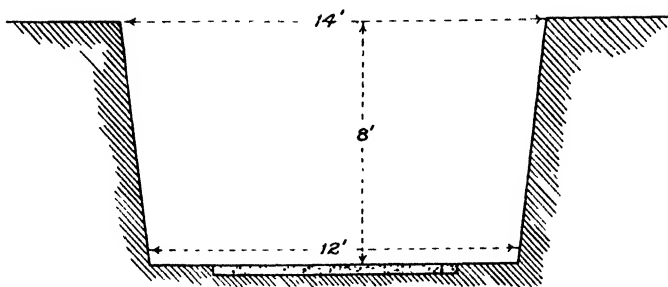
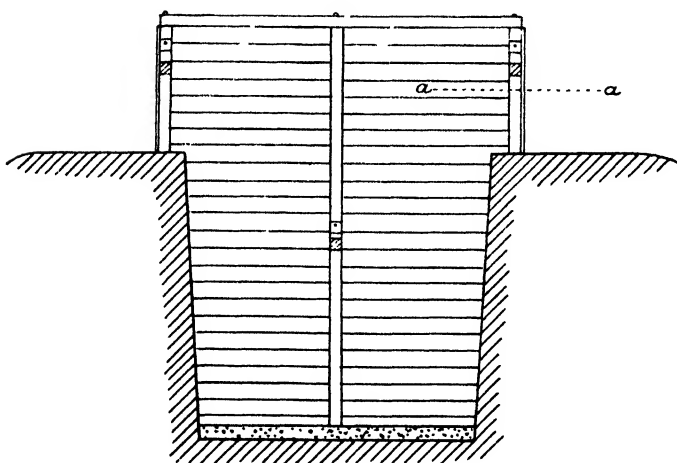
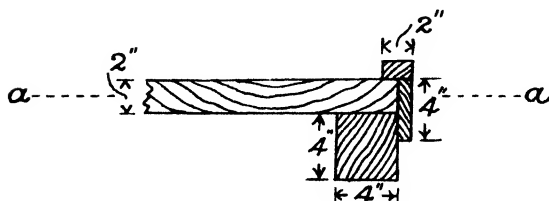


FIG 4a SECTION THROUGH a-a OF FIG 4

FIG. 4b. SECTION THROUGH *b b* OF FIG. 4.FIG. 4c. SECTION THROUGH *c-c* OF FIG. 4FIG. 4d. DETAIL *a-a* IN FIG. 4c.

7 to 9 tons, and good crops up to 10 or 12 tons; special crops of cereals or tares or peas about 10 tons, with extra-good giving as high as 12 to 14 tons; millet 12 to 16 tons; and maize about 30 tons, with extra-good crops running up to as high as 50 tons. About 20 tons is the minimum amount of material which should be put into an ensilage-stack. The approximate sizes of stacks are: 20 to 40 tons, 14 ft. by

14 ft. , 50 to 70 tons, 16 ft by 18 ft , 80 to 100 tons, 20 ft. by 24 ft. If reasonably good methods of saving are employed, each 30 tons of green material put into a stack should result in at least 20 tons of sound cured ensilage after allowing for all wastage.

Where very large quantities of material are being put in, a good square stack is probably the best , but for average conditions it will be found that a round stack gives the best results, being easier to build and showing very little waste when finished.

The best time to cut has already been dealt with, but it may again be stated that the material should go in at its best, and while it retains sufficient sap to bring about the necessary fermentation or cooking. Occasional showers during the building of the stack are generally an advantage, and necessary if the material has been allowed to become overripe.

Stacking Outfit The most useful outfit for the small farm is the mast stacker and grab, with one sweep. This outfit is conveniently worked by three men and a boy. If more labour is available two sweeps may be used, but then five or six men and a boy are required. There are various makes of mast outfits, but they all work on much the same principle. This outfit is equally useful for stacking hay. On larger farms, or where gangs of farmers are working together, stackers of the Deering type will be found more useful.

Building.— Having everything ready for a start, sufficient material should be cut and the stack built up to 8 ft. or 9 ft. the first day. Usually the material should be cut and put straight into the stack, with the exception of lucerne crops containing much very succulent material such as sow-thistles. In such cases the material may be allowed to wilt for a few hours before stacking. The stack, having been built up to 8 ft. or 9 ft., should be allowed to stand for one or more days until it has settled down properly, and until the temperature in the centre is between 120 and 130° F., the best ensilage being made between those points. The temperature having risen to the proper point, stacking may be continued from day to day, but if it is noticed that the stack is not settling or that the temperature is low it should be given another spell for a day or two. The general rule is: If the temperature is getting too high, add more material; if too low, refrain from adding material until it has reached the desired point. At one time it was thought that brown sweet ensilage was the best, but experience has shown that the green fruity kind has a greater feeding value than the brown. If the stack temperature does not exceed 130° the superior green ensilage will result.

Experienced ensilage-makers can tell from the feel and appearance of the stack if the temperature is right, but beginners will find it a great help to use a thermometer. All that is necessary is a piece of $\frac{3}{4}$ in. or 1 in. piping, 4 ft. to 6 ft. long. Into one end of this a pointed stick is placed and the pipe driven into the stack. The thermometer is then attached to a piece of string and lowered down the pipe. An ordinary milk-thermometer is satisfactory. The thermometer may be pulled up from time to time as required to ascertain the temperature. When ready to start building again the pipe and thermometer are removed, and at the end of the days' work replaced in position.

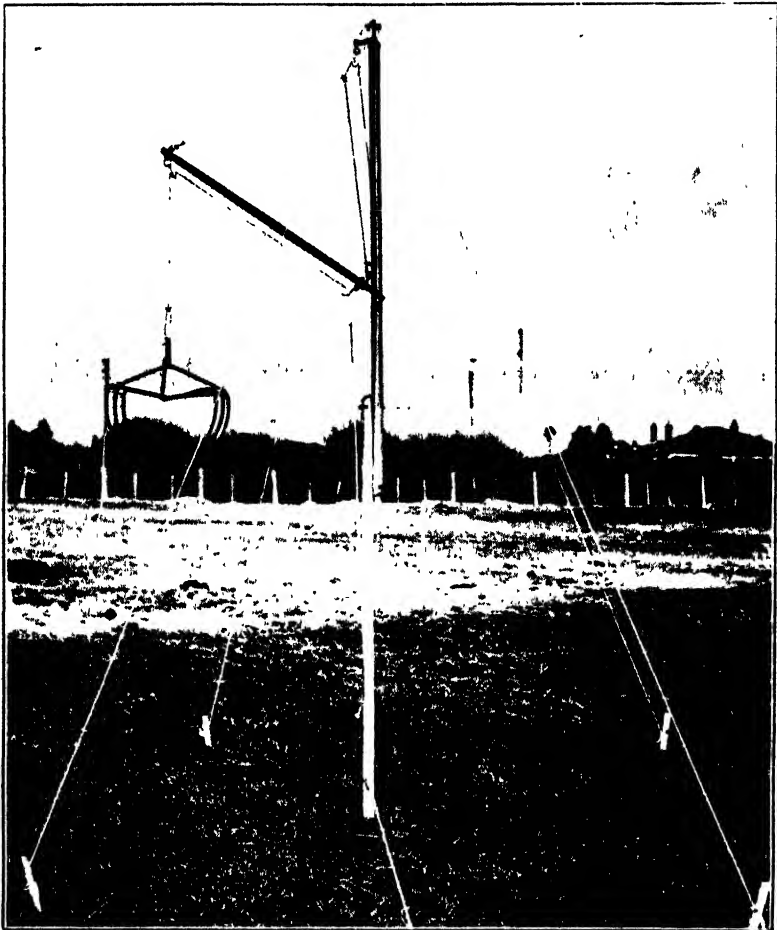


FIG. 5 MODEL MAST OUTFIT FOR STACKING ENSILAGE

When building the stack great care should be taken that the outside walls and corners are kept firm by tramping. The centre should be kept full, but not hearted up like a haystack, the idea being to keep the surface as near level as possible, with the walls hard and firm to exclude air. On finishing the stack it should be hearted up, so that when earth is applied the centre will be a little higher than the wall. During the process of building the stack should be frequently pulled hard and the material thrown into the centre. If while the stack is being built the wind is constant from one quarter it will have a tendency to drive the heat to the lee side and cause uneven heating and settling, with the result that the stack sometimes topples over. To guard against this a sheet or some sort should be hung on the exposed side while the wind is blowing.

Weighting. When the building of the stack is finished it must be weighted to cause even settling and control of temperature. In most places earth is the most suitable material for this purpose. If the stack is hot and settling quickly the earth should be put on at once, but if the settling is slow it is best to wait a day or two, as by this time the height of the stack will be considerably reduced, and it will be seen if the settling is even. It is good practice to fix a frame of some sort round the stack to hold the earth. This frame should go as near the edge as possible. The nearer the pressure can be got to the edge the less will be the wastage of material. Sometimes a frame of sawn timber made of two 6 in. by 1 in. lengthways, supported by 3 in. by 1 in. stays, and braced lengthways and across with fencing-wire, is used; but the more common practice is to place poles along the sides and ends, tie across with wire, and put earth inside them. Another useful method is to run a wire round the stack about 2 ft. from the edge, tying it with cross-wires, then filling old manure-bags or benzine-tins with soil, and hanging these to the wire to serve as a frame.

Probably one of the best methods is to secure some 10 in. by 1 in. boards, cut them to suitable lengths, and join them together with hinges made of ordinary fencing-wire. For square stacks the timber should be cut in lengths to suit the size of the stack, but for round stacks the boards are cut to 3 ft. lengths. Another common method of holding the earth is to put some heavy sheep-netting round the stack, line it with sods or grass, and then fill in. Others, again, simply put the earth on and trust to luck in getting it as near the edge as possible, but in this way the loss around the stack is greater.

The soil should be put on to a depth of 9 in. to 10 in. along the sides, running to 15 in. to 18 in. in the centre. If the season is very dry it will pay to double the quantities of earth.

The stack should be watched for a week or two to see that it settles evenly, some of the earth being moved from place to place, or more added if found necessary.

The silage may be fed at any time, but it is better to let it stand a month or two. When ready to use it, only a small area of the stack should be opened at once, so that at least 6 in. of the whole area opened will be removed daily. Ensilage deteriorates rapidly when exposed to the air. In feeding, a start should be made with 2 lb. or 3 lb. per cow until the animals get used to it, gradually increasing up to 30 lb. or 40 lb., which should be the maximum per day for ordinary purposes. On the average a cubic foot of ensilage weighs about 45 lb.

USE OF SALT.

During the progress of making ensilage it is a good practice to add salt, as this improves the quality of the silage and is a good way of feeding salt to the stock. The poorer the material the more salt should be added. From 4 lb. to 6 lb. should be used per ton of green material. Stock feeding on silage to which salt has been added will require plenty of good water.

METHODS OF TRANSPORT AND UNLOADING.

Various means may be adopted to transport the green material to the stack, pit, trench, or silo, those generally used being the sweep,

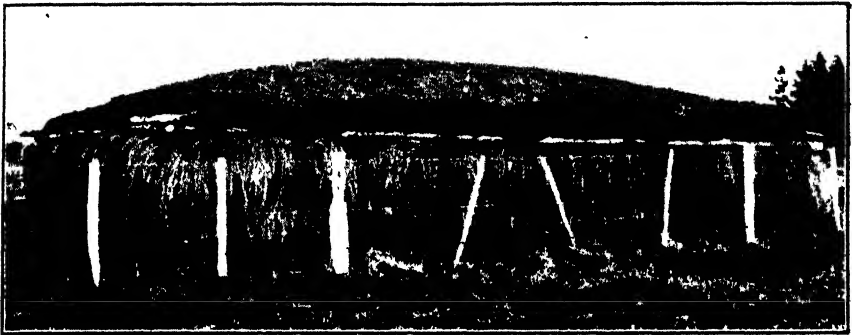


FIG. 6 WEIL COVERED ENSILAGE-STACK, WITH EARTH HELD IN POSITION BY POLES



FIG 7 STACK WITH EARTH HELD IN POSITION BY WIRE NETTING



FIG 8. MANURE-BAGS USED TO HOLD EARTH IN POSITION.

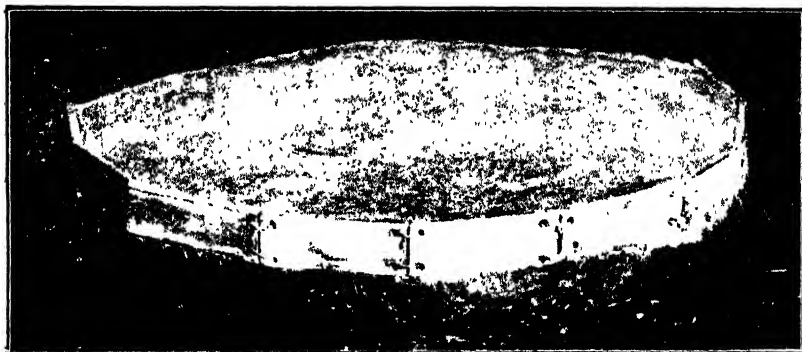


FIG 9. MODEL SHOWING METHOD OF TYING BOARDS WITH FENCING WIRE FOR HOLDING EARTH ON STACK

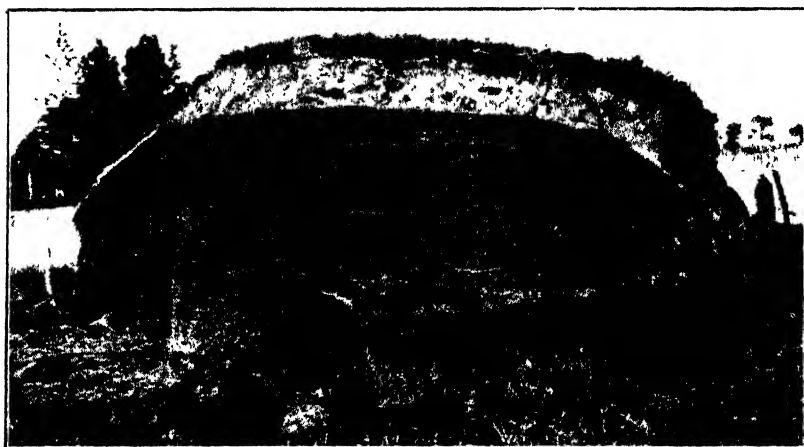


FIG 10. STACK WITH CENTRE WELL COVERED, BUT WEAK ON OUTSIDE EDGES



FIG 11. EXAMPLE OF STACK MADE WITH 100 LARGE A BASE FOR QUANTITY OF MATERIAL.

the sledge, and the dray. For general purposes the sweep is easily the best; next to this an easy-running sledge; and then the dray. If the dray has a tip so much the better, as this greatly facilitates unloading, particularly when driving over a trench. If the ordinary dray is used it is advisable to use a rope to assist in the unloading. This rope is placed on the bottom of the dray, with the two ends fastened at the back and the loops hanging loosely in front. When the material is brought to the place of unloading another rope is thrown over the load from behind and hooked on the loop of the rope already on the dray. The loose end of the second rope is then half-hitched round a post and the dray driven forward, depositing the load where required, the actual place of deposit being decided by the length of loose rope left between the dray and the posts. The same method may be used for unloading a sledge. Another good way of unloading a sledge is to put in two posts, one against the stack or pit, and one a sufficient distance out to allow the sledge to be driven between the two posts. A rope is fastened to one of these posts, then when the loaded sledge is in position the rope is brought round the front of the load about 2 ft above the sledge and the sledge driven forward.

WHY FARMERS SHOULD MAKE ENSILAGE

(1) Weather does not to any extent interfere with ensilage-making, consequently grass or special crops may be cut just when they are at the right stage of growth.

(2) The making of ensilage is one of the greatest helps in grassland management, and, by providing a sure and economic means for the removal of surplus grass, it enables the farmer to keep his pastures in a fresh green condition.

(3) By proper management and a full use of ensilage it is possible to economically utilize the surplus grass during the flush period and thus get a high return from the money spent on fertilizers. Economic butterfat-production per acre is far more important than the average butterfat-production per cow.

(4) By providing good succulent fodder in the non-growing periods, ensilage enables the farmer to keep his stock in good condition and carry a sufficient number to enable him to make a highly profitable use of the greater proportion of his grass during the flush season.

(5) For feeding during dry spells in summer, and for autumn, winter, and spring, silage is excellent. The yield from silage-fed cows is equal to that of cows fed on the average green crops.

(6) Coarse grasses and plants, which have very little feeding-value when made into hay, make very useful silage.

(7) Silage may be used as soon as it is saved, or, if properly made, it may be kept for a number of years.

(8) Cows fed on silage and hay come into profit in better condition than cows fed on hay and roots or hay alone.

(9) Silage can be made from most fodders that are grown for stock.

(10) A good supply of ensilage is the best insurance policy a farmer can carry. It provides a high-class succulent fodder for any period of the year.

MOULDS IN UNSALTED BUTTER.

RESEARCH AT WALLACEVILLE LABORATORY.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Division, Wallaceville Laboratory.

(Concluded)

CLADOSPORIUM HERBARUM AND CLADOSPORIUM BUTYRI.

These two moulds will be considered together so far as their effect on dairy-produce is concerned, as they are similar in most respects, there being only a slight difference in their cultural characteristics.

The *Cladosporia* are a common cause of discoloration in unsalted butter, and produce large olive-green to brown patches in butter in which they may be growing. Both moulds cause the same discoloration. Contamination of unsalted butter with this type of mould is far more prevalent in the butter-room than in any other part of the factory. The spores have never been isolated from butter-box wood or butter parchment during the time that work on butter-moulds was being carried out. While it is possible that contamination of butters in this manner with these two types of mould may occur, it can be safely said that this is not common. When petri dishes were exposed overnight to factory atmosphere beside the vats in which the cream remains for churning on the following morning, colonies of the two *Cladosporia* were far the most numerous type of mould found present. Spores of this mould have been isolated from factory water-supplies.

Mycelial Growth and Spore-formation — Staining methods have not been found satisfactory for examining the structure of the heads of this type of mould. The structure of the head seems to be more delicate than that of the other types, and when the mould comes into contact with liquid or glycerine, or when the head is removed from the colony on which it is growing, however carefully this is done, the branching portion of the head becomes detached and no trace of the branching structure remains. The heads of the *Cladosporia* usually tend to a very dense development. The conidiophores of *Cladosporium herbarum* are dense, bushy, a deep olive in colour, and compact in growth. In this respect they differ from those of *Cladosporium butyri*, which develop a dense olive growth in the centre of a colony, but show a somewhat straggling white growth on the outside and top, forming a white ring. The white ring seems typical of the growth of this mould on artificial media. In dairy-produce and on butter the loose surface growths of straggling white heads are characteristic, though it is impossible to differentiate between them with the naked eye if an aerial mycelium is not formed. The discoloration caused by these moulds is the same in both cases. The formation of the branched head of the *Cladosporia* occurs at the end of a fairly short aerial growth. Branching commences with short hyphal cells constricted at both ends and giving rise to further short constricted cells. At the connection of these cells branching occurs by the budding-out of further cells of the same type, which again bud out further very short cells that are oval and yeast-shaped and form the majority of the spores by which the mould is propagated.



FIG. 12 CULTURE OF CLADOSPORIUM HERBARUM ON ARTIFICIAL MEDIUM.



FIG. 13 PHOTOMICROGRAPH OF CONIDIOPHORE AND CONIDIA OF CLADOSPORIUM HERBARUM ($\frac{1}{6}$ LENS).

[Photos by G. F. V. Morgan.

Thermal Death-point—Germination has been obtained by spores that have been subjected to a temperature of 60° C., but not higher than 70° C.

Resistance to Brine Solutions.—*Cladosporium herbarum* will germinate and grow in a medium containing 7 per cent. of salt. Germination has been obtained from spores of *Cladosporium butyri* in media containing 8 per cent. of salt. *C. butyri* seems to be slightly more resistant to salt than *C. herbarum*.

Resistance to Disinfectants.—Spores will germinate after remaining in 5 per cent. formalin for ten minutes. They are also capable of germination after remaining in water for three months.

Biochemical Reactions Moulds of the *Cladosporium* species are capable of very rapid breakdown of protein second only to *Oidium lactis*, with the production of gas and an alkalinity of the medium.

Anaerobic Growth -- No development was obtained from young spores of *Cladosporia* in one week under strictly anaerobic conditions when incubated at 20° C.

Behaviour under Cold-storage Conditions. -- *Cladosporia* are capable of germination after remaining under cold-storage conditions for three months at 5° C. in not less than three weeks after the butter has been defrosted

General Observations on Butter-moulds.

Biological factors causing the deterioration of unsalted butters belong to three type---bacteria (fission fungi), yeasts (imperfect fungi), and moulds (fungi proper). These three groups form a continual source of deterioration from the time the butter is made to the time it leaves cold storage.

Bacteria come first in this process, their maximum activity occurring in the cream before churning and in the butter directly after manufacture. From the first twenty-four hours after manufacture their numbers decrease, till in six weeks only one-third of the original count remains, a large number of which are spore-forming organisms. Butter held under cold-storage conditions decreases in bacterial count much sooner than that held at room-temperature. Yeasts are plentiful in all unsalted butters, and their activity may be noticed from the time of manufacture to the time the butter is consumed. Mould-spores enter the butter during manufacture and remain dormant for some time before germination takes place. In this way germination of mould-spores rarely takes place before the butter is placed in cold storage, and it passes out of the country as mould-free. The spores will not germinate in cold storage, but are capable of slow germination after defrosting on removal from cold storage. By this time, in the case of New Zealand unsalted butter, a large proportion of the bacteria will have disappeared, but mould-spores and yeasts remain in abundance and carry on the process of deterioration.

In recent years a considerable amount of experimental work has been carried out on moulds in unsalted butter, and a number of short articles and papers have appeared on this subject. Mould-counts in particular have recently been adopted by wholesale firms buying unsalted butter. These counts should be a great guide to the quality of the butter purchased. Certain well-known workers in dairy science in different parts of the world have been inclined recently to throw discredit on the mould-count as an indication of quality, owing to very varied results being obtained.

Experiments carried out very carefully and under standard conditions in New Zealand have shown that the mould-count, if properly conducted, is of considerable value. Variations in mould-counts may occur from several factors. The most important is insufficiency of time allowed for germination after defrosting. Work at Wallaceville has demonstrated that there is often a considerable difference in the time required for germination of mould-spores of the same species. There is also a very considerable difference between the time required for the spores of

various genera of moulds to germinate if they have remained under cold-storage conditions for any length of time. Experiments carried out in the cold stores at Wellington have, over a number of tests, shown that in this respect butter-moulds may be divided into two classes—those that germinate fairly soon after defrosting, and those that germinate only a considerable time after defrosting. Members of the first group are *Penicillium glaucum*, *Oidium lactis*, and *Stemphylium*, germinating in from four days to two weeks. The second group consists of *Fusarium lactis*, *Cladosporium herbarum*, and *Cladosporium butyri*, germinating in not less than one month after defrosting, having remained at an average temperature of 55° C. for three months



FIG. 14. CULTURE OF STEMPHYLIUM ON ARTIFICIAL MEDIUM.

Photo by G. I. V. Morgan.

This brings forward an important point in connection with the taking and culturing of butter-samples for mould-counts. Cultures for mould from butter-samples that have been in cold store for any length of time should never be thrown away till at least one month has elapsed from the time the butter examined was defrosted, as the spores of the mould that will not germinate in less than one month after defrosting will not germinate any sooner when they are transferred to a fresh medium. To this end care should be taken that the loss of moisture from the medium in the petri dish or test tube in which the culture is made is not too great. Unless precautions are taken solid media will, in less than a month, become too dry to be suitable for mould development

Another important factor in obtaining consistent results with mould-counts is the use of suitable media. After a trial of a number of media at the Wallaceville Laboratory, Czapeks solution agar was found to be the most reliable medium for the growth of *Penicillia*, *Fusaria*, and *Stemphylium*. Malt agar was found most suitable for the growth of

the *Cladosporia* and *Ordium lactis*. In plating out butter-samples for moulds it was found most satisfactory to take the lowest dilution—namely, 1 to 10—and with a 1 c.c. pipette with a fine-point drop, culture 1 c.c. of the dilution over the surface of the medium to be used in a large petri dish. On no account should shake cultures of dilutions for mould-growth be used. If these points are observed in the examination of butters for moulds consistent results will be obtained, and little decrease in mould-counts will be found during the time the sample remains in cold storage.

COMPARISON OF MOULD AND BACTERIAL ACTIVITY IN BUTTER.

<i>Bacteria</i>	<i>Moulds.</i>
(1) Bacteria destroyed by pasteurization	Mould-spores destroyed by pasteurization
(2) Contamination in the factory general	Contamination mainly through cream remaining exposed in factory atmosphere in freezing-vats, contaminated water-supplies, and parchment
(3) Bacterial count per gramme frequently over 1,000,000	Mould-counts per gramme rarely over 300
(4) Bacteria decrease steadily, whether the butter is placed in cold store or remains at atmospheric temperature	Mould-spores germinate in less than two weeks in unsalted butter kept at room temperature, causing discoloration. Spores remain virile in cold store and do not decrease in number
(5) Bacteria vary considerably, decrease in number after three months at cold-storage temperature, majority remaining are spore-formers	Mould-spores not decreased in number, speed of germination retarded
(6) Bacteria susceptible to their own toxic products, which limits their development	Moulds can continue growth till all available food-supplies are consumed and the medium covered
(7) Bacterial activity limited by the acidity or alkalinity of the medium in which it is growing	Moulds grow equally well in acid or alkaline media. (Extensive cultures over a varied pH range were made for all moulds.)
(8) Bacterial action may continue for a considerable time unnoticed	Presence of mould immediate—visible on germination

Precautions against Mould Contamination.

Precautions should be taken against mould contamination in butter-factories. One of the first and most important steps is to see that the factory is thoroughly well ventilated, and that the steam rising from the pasteurizers can be removed from the butter-room as soon as possible. Covered coolers are strongly to be recommended. All butter-parchment should be kept dry and covered. Butter-boxes should also be kept dry and covered by their lids, instead of allowing the lids to remain inside.

Chilled water-tanks should always be covered, preferably with metal, if the water is to be used for washing butter. (It is most desirable to pasteurize washing-water, as it frequently becomes contaminated at its source with mould-spores and bacteria.) Only butter-parchment of the best quality should be used; trouble with moulds nearly always arises when butter-parchment of poor quality is used. Mould-counts taken from cheap butter-parchment at the Wallaceville Laboratory have in some cases been very high, and in some cases virile mould-spores (*Penicillia*) have been isolated from the

body of the parchment itself, showing that contamination of parchment may occur in careless manufacture. When moulds have obtained a firm footing in a butter-factory remedial methods should be adopted, though most of the methods at present practised are only very temporary in their effects. Strong limewash and formalin are more effective together than used separately. Such disinfection should be carried out at least once a month.

The fact that most moulds will germinate in a medium containing 6 or 7 per cent. of salt draws attention to the true salt percentage of salted butter from the biological point of view. New Zealand salted butter generally contains $1\frac{1}{2}$ to 2 per cent. of salt; this salt percentage is worked out on the whole bulk of the butter, including fat. The salt, however, after it is worked into the butter is not absorbed by the fat, but remains in solution in the butter-water (about 16 per cent.) surrounding the fat globules. Therefore the true salt percentage considered from the biologic point of view should be worked out on the total salt percentage in the percentage of water present, and not in the total bulk of the butter.

Spores of *Penicillia* and *Oidia* are frequently found in samples of unsalted butter after subculturing in artificial media, but development of mould in salted butter itself is rarely seen. These mould-spores have remained virile in salted butter for perhaps three months at cold-storage temperature, but have been unable to germinate in the butter-moisture of high salt content. They have, however, been able to germinate again when removed to a non-saline artificial medium. When mould investigation work is undertaken control cultures should always be carried out in sterile butter.

Contamination of butter-parchments during their manufacture occurs through the washing of the pulp after treatment with sulphuric acid by contaminated waters, which introduce mould-spores into the substance of the paper before manufacture is complete.

THE OFFICIAL HERD-TEST.

THE second year's results of the official herd-test have borne out the expectation of increased support expressed in the review of the first season's work, which appeared in the *Journal* for September, 1928. The number of registered purebred cows on official herd-test at the height of last season was 1,066, as compared with some 1,550 in the flush of 1927-28.

The records for the first year were summarized to 31st July, 1928, but later experience has taught us that this closing-date was too early, and likely to occasion too large an overlap from season to season. While the great majority of O.H.T. entries up to the present have been for cows calving in early springtime, a number of entries are made for cows calving later in the year, and it is difficult to know where to draw the line for annual summarizing purposes. At present it would seem that 30th October will be the most suitable closing-date, and this assumption will be worked on for the present year at least. It is therefore expected that our second annual review of the O.H.T. system will appear in the *Journal* for November next.

—*Dairy Division.*

PUWERA GUM-LAND EXPERIMENTAL FARM.

PASTURE ESTABLISHMENT AND CARRYING-CAPACITY.

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THE gum-land clay areas of North Auckland consist of undulating, treeless downs rising occasionally into low hills. The surface soil is generally a clay which varies in texture from a strong white pipeclay to a yellow rubbly clay. The white pipeclays carry a low growth of manuka scrub, bracken-fern, and rushes, while on the yellow rubbly clays bracken-fern is often the dominant covering. The surface soil, being deficient in humus, is very sticky in the winter and bakes very hard during the dry summer weather. Cultivation is accordingly difficult and costly, as the land can only be satisfactorily ploughed and worked in the autumn and early winter, and again in the late spring and early summer.

In addition to the low natural fertility of the soil the grassing of the gum-land areas has been rendered still more difficult by the operations of gum-diggers. The ground was roughly dug up whenever gum was suspected to exist, and a thin layer of top soil, generally only a couple of inches thick, was buried a foot or more down; and deep holes were dug and left unfilled. But what led to the worst destruction of the soil was the continued burning-off of the covering scrub. The gum-digger did not cut down and clear away the vegetation on the surface of the ground he wished to clear; he resorted to the simple method of "putting a match into it." Fires started to clear a few yards often swept hundreds and thousands of acres. This repeated burning-off caused every vestige of dark surface soil to disappear and left a bare pipeclay surface soil on extensive areas of gum-land.

Although the gum-land in its natural state looks very unpromising, the grassing experiments conducted at Puwera Farm have shown that quite good pastures composed of rye-grass, paspalum, and white clover can be established and maintained on these poor clay soils. The experimental work conducted on the farm has been reported on from time to time in the *Journal* since 1921, and the purpose of this article is to briefly summarize the grassing operations carried out, and to bring the information up to date from the publication of the last report in 1927.

METHODS OF GRASSING GUM-LAND.

The surface covering of the land is first cut and burnt, and the holes left by the gum-diggers filled in. The amount of work involved in filling in holes varies considerably on different areas, in some places there is practically none of this work to be done, while in other places it may cost up to £2 per acre to prepare the land for ploughing. On other areas, where only the surface of the land has been worked by the gum-digger's spade, the uneven surface, covered by huge clods, has often to be partially cleared and levelled by hand before it can be satisfactorily ploughed.

The varied condition of the surface has led to several different methods being adopted for breaking-in the land. The chief among these are briefly as follows:—

(1) Surface cultivation with disks and harrows, followed by the sowing of a comparatively light grass mixture. *Lotus hispidus* is an important constituent of the primary sowings; it establishes quickly on the poor clay soils, and greatly improves the quality of the land on which it is growing. The temporary pasture is left down from two to four years, and the land ploughed and sown down to permanent grass.

(2) The land is ploughed and left fallow for six to twelve months, then worked up and sown in permanent grass. Sometimes an annual crop is taken before the land is sown to grass.

(3) The land is ploughed, fallowed six to twelve months, reploughed and subsoiled, limed, and sown to permanent grass. Again an annual crop may be taken before the land is sown in grass.

At Puwera the early pastures were sown down after the thorough preparation of the land as outlined in (3) above, while the later sowings were made after only one ploughing and a short fallow. New pastures on gum-land have usually only a low carrying-capacity, and it takes several years of regular top-dressing with phosphates and careful stocking before a good sward of grass is obtained. The older pastures at Puwera are now quite good dairying grassland, whereas the newer ones still contain a fair proportion of bare ground, and it will take a year or two of careful management before they are brought up to the level of the old pastures.

CARRYING-CAPACITY OF THE PASTURES AT PUWERA FARM.

During last season a careful record was kept of the stock-grazing days for each field on the farm, and the carrying-capacity of all the improved fields from September, 1928, to June, 1929, is given in the following table :—

Present Field Number.	Old Field Number	Area.	Milking-cow Days per Acre.	Dry-stock Days per Acre.	Type of Pasture.
		Acres.			
1*	1	3	63	28	Rye, cocksfoot, kikuyu, and white clover
2†	2	7	97	42	Rye, paspalum, kikuyu, and white clover
3	3A	2½	331	57	Rye and white clover.
4	3A	2½	362	115	Rye and white clover.
5	3B	4	..	..	(Dairy-shed paddock.)
6	3B	2½	291	70	Rye and white clover
7	3B	2½	345	74	Rye and white clover
8	4	8	91	31	Kikuyu and brown-top.
9	5	12	289	32	Rye, paspalum, subterranean and white clovers.
10‡	6	8	124	34	Paspalum, rye, and white clover.
11‡	6	2½	24	..	Paspalum, rye, and white clover.
13	..	12	..	..	(New grass.)
14	7	3	208	68	Rye and white clover
21*	..	8	..	56	Rye, white clover, and <i>Lotus hispidus</i> .
22	..	13	..	100	Rye, brown-top, paspalum, and white clover.
23	..	20	..	44	Rye, white and subterranean clover, and bare ground.

* Cut for hay.

† Rank growth mown for hay.

‡ Cut for ensilage.



MILKING COWS GRAZING FIELD 4 AT PUWERA FARM IN AUGUST, 1929

The field was dressed with 1 cwt sulphate of ammonia on 8th July, and gave fourteen cow-grazing days per acre from 8th to 10th August. Farm-buildings seen in middle distance.

Fields 1 and 2 are situated on fairly good flat land, and for a number of years were used for the production of annual crops and experimental grass sowings. Field 1 now contains three different pasture sowings: a section of old cocksfoot pasture which was sown down in 1917, a section in kikuyu-grass planted in 1920, and a rye-grass and white clover pasture sown in 1926. Field 2 also contains sections sown in pasture at different times; part of the field was planted in kikuyu in 1922, part sown in paspalum in the same year, and the remainder sown in a rye-grass and white clover pasture in 1926. The kikuyu-grass in these fields has now become sod-bound and is not throwing a great deal of feed. Although this grass has probably a place in grassing poor bare patches on slips, it cannot be recommended at all for land capable of carrying a rye-grass - paspalum - white clover type of pasture.

Fields 3, 4, 5, 6, and 7 are situated on fairly good flat land, and the pastures consist of perennial rye-grass with a sprinkling of paspalum. The area now occupied by Fields 3 and 4 was first ploughed between 1920 and 1922, fallowed, drained, cropped with soft turnips, swedes, and green cereals, limed, and sown in grass in April, 1923. Fields 5, 6, and 7 were first ploughed in 1919, drained, limed, subsoiled, cropped with soft turnips, swedes, and rape, and sown in grass in the autumn of 1921. For a few years after sowing the pastures were of only medium productivity, but a good strain of perennial rye-grass was sown in the original mixture, and as the surface fertility was built up by regular phosphatic manuring the pastures improved wonderfully, and are now first-class dairying grassland.

Field 9 is situated on a steep pipeclay hill, and is an excellent example of the effect of regular phosphatic top-dressing in converting quite a poor strike of grass into a good dairying pasture. The field

was broken up in 1918, cropped with oats, again ploughed, limed, and sown in mustard. The mustard was ploughed in as a green manure, the land again limed, and sown in grass in the autumn of 1920. The field was laid out in eight plots, which were sown in various grass mixtures running from an Italian rye-grass and *paspalum* mixture to a perennial rye-grass, cocksfoot, dogstail, and *paspalum* mixture. As indicated, the original strike of grass was poor, but regular top-dressing has built up the surface fertility, and the pasture over the whole field now consists of perennial rye-grass, *paspalum*, and white and subterranean clovers. During the past season the field gave 289 cow grazing days and 32 dry-stock days per acre, which is quite a high carrying-capacity for a field of this size.

Turning to the newer grass-sowings on the farm—Fields 21, 22, and 23—it will be seen on referring to the table giving the grazing-days for each field on the farm that they have produced very little feed during the past season. These fields, however, now possess quite as good a turf as that of Field 9 for the first few years after it was sown, and it is reasonable to suppose that regular top-dressing and careful stocking will ultimately bring them up to as high a carrying-capacity as the older fields. Fields 22 and 23 consist of steep clay ridges, and were grassed down in 1926 and 1927.

Field 22 was first ploughed in the spring of 1925, the land then lay fallow till the spring of 1926, when it was disked up and sown in grass in September. The following grass mixture was used: Italian rye-grass, 4 lb.; perennial rye-grass, 10 lb.; crested dogstail, 3 lb.; *paspalum*, 12 lb.; brown-top, $\frac{1}{2}$ lb., red clover, 3 lb.; white clover, 2 lb.; subterranean clover, $\frac{1}{2}$ lb.; total, 35 lb. per acre. Before sowing to grass the land was dressed with 4 cwt. of basic slag, and 3 cwt. of super was sown with the grass mixture. The field was top-dressed in 1927 with 3 cwt. of basic super, and in 1928 and 1929 with 3 cwt. of basic slag. Up to a year ago the pasture on this field was very thin, but it is now thickening up, and *paspalum* is appearing in most parts. Next season the field should provide a good deal of grazing.

Field 23 was first ploughed in the spring of 1926; it lay fallow till the autumn of 1927, when it was disked up and sown down in grass in March. The following grass mixture was used: Italian rye-grass, 5 lb.; perennial rye-grass, 10 lb.; crested dogstail, 3 lb.; *paspalum*, 7 lb.; red clover, 3 lb.; white clover, 2 lb.; Lotus major, $\frac{1}{2}$ lb.; and subterranean clover, $\frac{1}{2}$ lb.; total, 30 $\frac{1}{2}$ lb. per acre. Prior to sowing in grass, part of the field was divided into plots to test the value of heavy dressings of phosphates in promoting a quick establishment of grass. Two plots, each about 2 acres in area, were given 9 cwt. of basic slag, and two plots 9 cwt. of Seychelles guano; the remainder of the field was left as a check plot; 3 cwt. of superphosphate was sown with the grass mixture over the whole field. The plots that received the 9 cwt. of basic slag have always been the best parts of the field, and during the past two seasons have carried a good growth of red clover. The general pasture in the field is still open and poor, although it has thickened up appreciably during the past season. The field was top-dressed with 3 cwt. of basic slag in 1928 and 1929.

Gum-land clays can be made to carry good pastures, but the chief factor preventing the unoccupied areas being broken in for settlement is the length of time that elapses between the sowing-down of the grass

and the establishment of a good pasture. On most gum-land it takes three to five years, with regular top-dressing and careful stocking, to convert the thin, open turf on the newly turned clay into a good rye-grass, paspalum, and white-clover pasture. During the early part of this period the land gives very little good grazing, and the amount expended annually on manures for top-dressing and interest on the cost of putting the land in grass has to be met out of the settler's capital.

WATER-SUPPLY.

A large proportion of the gum-land clays are badly watered. During the winter, after the surface soil has become wet and sticky, practically the whole of the rain-water runs off the surface and very little soaks down into the deeper layers of the soil. Creeks with a strong winter flow go dry early in the summer. At Puwera Farm the water-supply is provided by dams cut in the hillsides, in which is collected water which runs off the surface of the fields in the winter and spring. The water is of poor quality, and the supply fails during dry weather. Bores have been put down at Puwera to a depth of 300 ft., but no adequate water-supply has been obtained from them, and a pumping scheme for a regular supply for the farm is now under consideration.

MISCELLANEOUS NOTES.

During the 1927-28 season the pastures and stock on the farm suffered from the abnormally dry summer weather. All the pastures burnt up badly, and the stock had to be carried for nearly three months on ensilage and hay. Thirty-six cows were milked during the season, and 7,139 lb. of butterfat was supplied to the factory. During the 1928-29 season the general calving of the herd was late, and although a total of forty cows were milked the butterfat production was only 7,369 lb. All late-calving cows and cows not got in calf last season are being milked through this winter, and by this means it is ultimately hoped to get the whole herd calving again in July-August.

Last season an ensilage-pit was dug out of the hillside in Field 10. The pit is fitted with a narrow boarded entrance, which prevents the green material, after the pit is filled, creeping towards the entrance and leaving a space between the earth walls and the ensilage. If an air-space forms in this way there is often a good deal of waste. The material used to fill the pit consisted of rye-grass, paspalum, and clovers, and made excellent silage. The waste on the sides and ends of the pit was negligible. The silage was fed to the milking-cows during the past winter.

During the past season Fields 3, 4, 6, and 7 were used for grazing experiments to test the value of nitrogenous fertilizers in producing increased grass-growth. These experiments are part of a large programme with nitrogenous fertilizers which is being conducted in all parts of the North Island. Field 4 received four 1 cwt. dressings of sulphate of ammonia, and Field 7 four 1 cwt. dressings of Nitro-chalk. From September to June Field 4 gave 31 cow-grazing days and 58 dry-stock days more than Field 3, and Field 7 gave 54 cow-grazing days and 4 dry-stock days more than Field 6. These experiments are being continued during the present season, and Field 9 has now been divided into four 4-acre fields, so that this experimental work may be extended.

CROWN-GRAFTING MATURED FRUIT-TREES.

THE INLAY METHOD.

M DAVFY, Orchard Instructor, Wellington.

OWING to changing conditions in variety and market values, the commercial orchardist is in many cases confronted with the desirability or necessity of grafting—or reworking, as it is commonly termed—some of his matured fruit-trees. Many different methods are in practice with varying success; but if the results are closely followed the proportion of success is often seriously low. To cut down matured trees which are in bearing generally entails some sacrifice, and it is essential that a recovery of this loss, and a subsequent increase in profits, should be assured.

THE INLAY METHOD.

The method here described is termed “inlaying,” and it has several features which may commend themselves to orchardists. The various operations are detailed below.

Cutting the stock. The process of cutting the stock consists in taking out an elongated V-shaped section of the hard wood, cambium layer, and bark, for a length of 3 in or more, *not less*, the cut to taper towards the bottom, as shown in Fig. 1. The position of the operator and his method of holding the knife should be noted.

Cutting the scion. Here special care is needed, remembering that a good fit will be one of the deciding factors in successful grafting. Place the scion immediately against and over the incision in the stock, taking care that the lower end of the scion corresponds with the base of the cut. Also note the direction of the two top buds on the scion for future leaders, and adjust if necessary. Then firmly press the scion against the top edges of the cut in the stock. This will mark the bark of the scion and indicate the length and portion to be removed in trimming and shaping. This precaution obviates the cut surface of the scion extending above the crown of the stock. In trimming the scion take two sides off, as shown in Fig. 2, leaving the third side with bark attached. Now glide the scion into the cut in stock, and gently press it downwards until it will remain in position with the pressure exerted on the cut sides.

Nailing in the scion: This should be carefully done with two nails (Fig. 3), taking care not to displace the scion from its original position.

Waxing the graft: This last operation, which is of importance, should not be done casually, care being taken to completely and thoroughly cover up and seal all cut surfaces (Fig. 6) with wax at a boiling temperature, not forgetting to apply a portion to the end of the scion to prevent drying out. (*This last item is most important.*) The firebox shown in Fig. 4 is assembled with an inner water-container to prevent wax boiling over, and with wax-tin in centre, both of which are fastened together with fine wire to prevent spilling. The firebox should have a long wire handle, as without this it becomes too hot for carrying about.

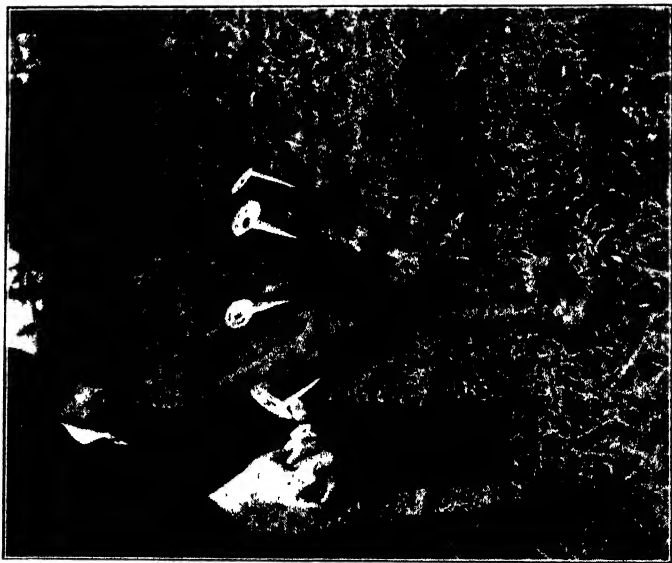


FIG. 1. CUTTING THE STOCK.

Note position of operator and method of holding the knife, also stumps cut sloping in order to shed moisture.

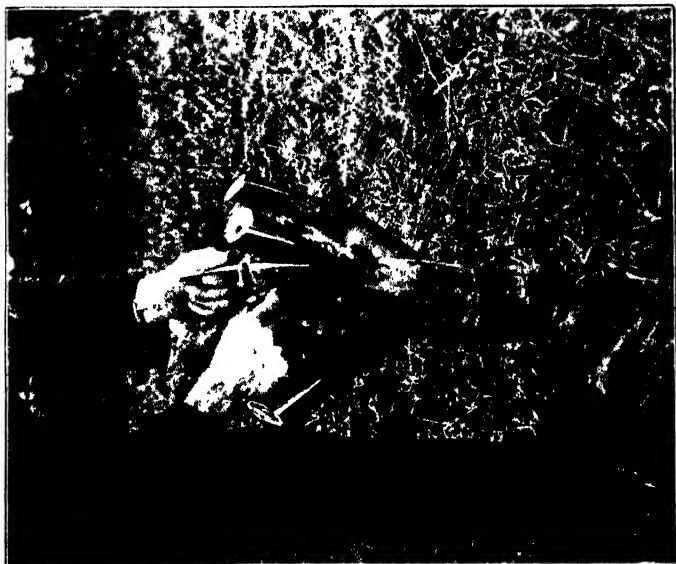


FIG. 2. TRIMMING THE SCION.

Two sides are taken off, and one side left with bark attached.

RESULTS OF INLAYING.

The strong and vigorous growth shown in Fig 5 indicates the results which may be expected if the work is well executed, and the style of pruning which should be adopted at the end of the season's growth. The results of inlaying on the lines described may be summarized as follows :--

- (1) A maximum contact of bark and cambium on scion and stock is effected.
- (2) Innumerable sap-bundles in the stock have been severed ready to discharge where corresponding sap-bundles in the scion are ready to absorb the life-giving juices of the tree.



FIG 3 NAILING IN THE SCION.

Two $\frac{1}{4}$ in. steel tangles are recommended for this purpose

- (3) No possible movement which may break the intimate contact of these parts can take place, owing to the uniform high pressure exerted by the nails, which also obviates any danger of grafts blowing out.

(4) No intrusion of free moisture or evaporation of sap can take place, owing to a perfectly hermetically sealed joint having been made by the thorough and careful application of the hot wax.

- (5) The boiling wax has additional advantages in that it sterilizes the cuts and seals up the wounds, thereby preventing infection from silver-leaf and other fungus and bacterial diseases.

SELECTION OF SCIONS.

This feature should receive due consideration. In choosing wood for grafting always select vigorous one-year shoots with well-developed

leaf-buds. The strongest leaf-buds are generally situated in the centre of the annual growth. On no account use buds which may be converted into blossom buds, owing either to abnormal vigour or weakness on the part of the tree from which they are obtained. A bloom and two weak shoots will eventuate if this class of bud is used. The only course to pursue in such a case is to pinch out the blossom and one shoot, when only fair growth can be expected. The true and normal leaf-bud is flat and of triangular shape, lying close to the shoot. The best time to cut scions is about a month before spring growth commences.

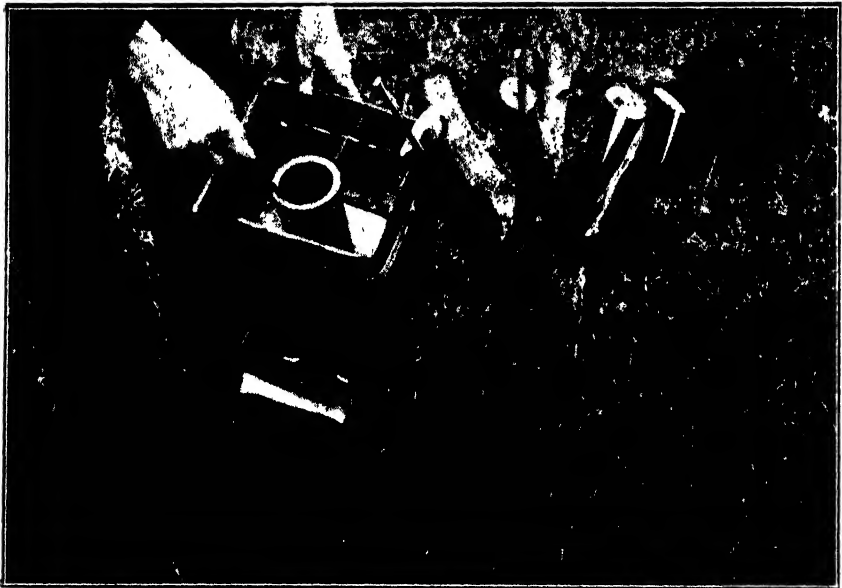


FIG. 4 APPARATUS FOR USE IN WAXING THE GRAFTS.

Showing fire-box, inner water-container, and wax-tin.

During the growing season following grafting any shoots springing from the stock should be suppressed, not by being entirely removed, but by pinching out the terminals. The reason for this is that the roots need stimulating or excitement until the grafts take up the running, otherwise the terminals of the roots die back. If the shoots from the stock are not checked in any way, the grafts become submerged and stifled by what is only waste energy.

CARE OF SCIONS.

This is another important feature which is often treated too carelessly. Do not be content to stick the scion half-way in the ground. This often means that when the scion is required for use it is as hard as the stock, and the leaves which are pushing from the ends



FIG. 5 STRONG AND VIGOROUS GROWTH OF WELL-EXECUTED INLAY GRAFTS

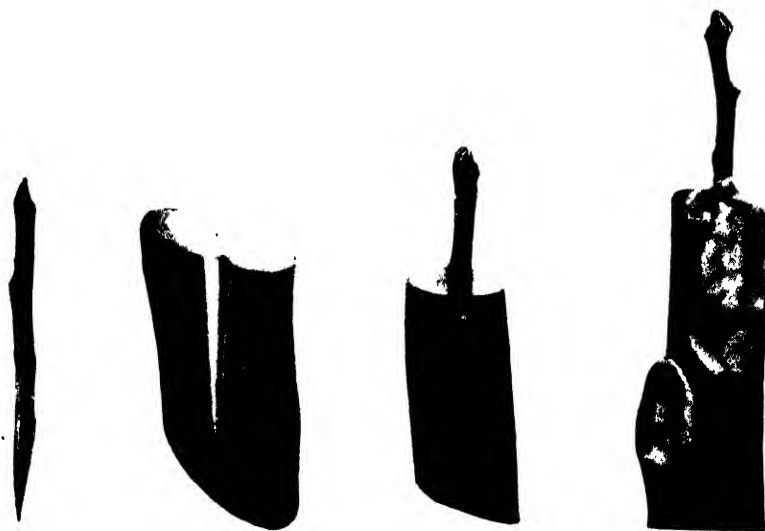


FIG. 6 FOUR STAGES OF INLAY GRAFTING

(1) Scion cut; (2) stock cut; (3) scion nailed in; (4) all cut surfaces waxed (including those of any limbs removed to facilitate grafting operations, as here shown below graft).

of the shoots have exhausted most of the vitality from the very portion of the twig used for grafts. In the place of this rough and unsound practice scions of the variety to be used are best left on the tree until August, and then placed in damp sand in a cool shed. Or as an alternative, dig an oblong hole 2 ft. deep in a cool, *well drained spot*, and bury the scions completely. The result of this will be that, when the scions are dug out, fresh, plump, and perfectly dormant wood with all its reserves unimpaired is available. After grafting, replace the surplus wood into storage, and if any failures occur through lack of skill or accident one still has reserves of dormant wood to fall back on and can renew failures.

VARIOUS NOTES.

The most common formula used in European nurseries for grafting-wax—namely, four parts resin, two parts beeswax, and one part mutton fat or tallow—gives excellent results. In addition, assuming the quantities specified to be pounds, an eggcupful of raw linseed-oil will increase elasticity and prevent cracking, especially in the colder districts. Generally the wax adheres until pushed out of place by scion or tree.

The firebox is made from a benzine-tin by perforating the sides and bottom to create draught. Cut an opening in one side for replenishing fuel. Pass two short lengths of fencing-wire through the sides midway to act as a rest for the inner tin containing water, which should have solder floated in the seams to prevent leakage.

The nails recommended are $\frac{1}{2}$ in. steel tingles, which can be purchased from most boot-repairing shops. These remain in the tree, and are grown over during the first season.

WORLD POULTRY CONGRESS, 1930.

THE Fourth World Poultry Congress will be held at the Crystal Palace, London, from 22nd to 30th July, 1930. The Congress is being organized by the British Government, and will be under the patronage of the King, the Queen, and the Prince of Wales. All persons interested in any aspect of poultry husbandry in any part of the world are invited to be present.

In connection with the Congress an Exhibition will be organized, comprising (1) national exhibits staged by participating countries; (2) exhibits of poultry, rabbits, and pigeons entered by breeders from all parts of the world; (3) commercial exhibits of interest to the poultry industry.

Information regarding entry fees for exhibitors and membership charges for delegates, together with plans and all other particulars concerning the Congress, may be obtained on application to the Secretary, World Poultry Congress, 10 Whitehall Place, London S W. 1.

Importation of Stud Stock from Abroad—Outbreaks of foot-and-mouth disease in Britain having persisted, the embargo on cattle, sheep, and swine from Great Britain is still in force. The only countries from which cattle may be imported into New Zealand at present are Tasmania, Canada, and the United States (with the exception of the State of California); swine may also be introduced from the same countries. The following animals from abroad entered into quarantine during the official year 1928–29 to undergo the required period of detention: Horses, 11; cattle, 29; swine, 33; dogs, 59.

FRUIT VARIETIES FOR NORTH AUCKLAND CONDITIONS.

RESULTS AT TANEKAHA TEST ARFA.

W. H. RICE, Orchard Instructor, Auckland.

FOR the purpose of testing the suitability of soil and district for different varieties of pip- and stone-fruit a co-operative seven-year trial was arranged in 1922 between the Department of Agriculture and Mr. F. G. Long, of Tanekaha. This place is situated some five miles from Hikurangi, north of Whangarei, while the selected site which was planted in trees is typical of large areas of land in the locality and in the immediate north through the Jordan Valley. The soil is clay, requires drainage, and with green crops and continued cultivation becomes of good texture, though inclined to be wet in winter, mainly through the compact limestone subsoil and under-strata.

For shelter insignis pine was selected, a single line of two-year-old trees being set out 4 ft. apart. At the end of seven years they have grown into trees 40 ft. high and 10 in. diameter of trunk 1 ft. above ground. They are at present dense to the ground, but the growth indicates that the trees should be topped if lower growth is to be retained. The character of this shelter in relation to the fruit-trees shows that, while it is very suitable for the purpose, a greater distance than 20 ft. should be left for a headland.

During the period of the test all trees, according to variety, received precautionary sprays, and no pest or disease became established. Damage to trees or loss of crop attributable to pest or disease was negligible. Orthodox cultivation and green manuring was resorted to to keep the land in good condition. A normal manurial programme with fertilizers was carried out, no special attention being given to individual tree requirements, as it was considered that suitability of variety to soil and location could best be determined under nearly normal conditions.

Apples.

There are two types of tree on the area—varieties planted in 1922 and varieties grafted in 1925 on to stocks which had been planted in the permanent quarters in 1922. All apples are on Northern Spy root-stock. The following observations are recorded from a recent inspection of the trees:—

Albany Beauty. Remarkably vigorous trees of exceptionally heavy build, good furnishings, and very fruitful. Could confidently be planted in the locality.

Alfriston.—Medium growth, only sparsely furnished. So far of shy cropping habit. Not to be recommended.

Ballarat.—Well suited to land and locality. Not large trees, but highly fruitful and desirable.

Becroft.—Grafted in 1925. Very heavy growth, but poor furnishings. No fruit yet.

Brighton.—Sturdy, heavy frame; inclined to be bushy in habit; liberally furnished with laterals; very fruitful. Good in every way.

Celo. Grafted in 1925. Have made excellent trees, and promise well for fruiting. To be recommended.

Cox's Orange Pippin.--Well suited, and excellent in every way.

Delicious.--Have made nice trees, not particularly robust but easy to train. Somewhat shy in bearing. Not as well suited to this locality as to many.

Dougherty. Well suited, good in every way.

Dunn's. Well-grown trees of sturdy character, but shy in fruiting.

Grant Jennetson.--Well suited to the locality and soil; nice tree, and fruitful. To be recommended.

Glengyle Red. Grafted in 1925. Fair only; poor growth of a weak nature. Not well suited.

Golden Delicious. Grafts from 1926. Doing well, and of great promise.

Gravenstein. Well suited, among best trees on the area. Desirable in every way.

Grannie Smith. Quite adaptable to the locality. Inclined to slender growth, and sparsely furnished with laterals, but nevertheless fruitful on main growth and spurs.

Jonathan.--Poor growth and very slender habit in this location. Fruitful and highly coloured, but not robust enough to justify planting.

King David. Heavy growth and robust tree. Very fruitful and desirable, high degree of colour.

McIntosh Red.--Grafted in 1925, making good growth. Appears to be well suited, though not fruiting yet.

Parlin's Beauty. Tree well suited to locality. Strong robust growth, though somewhat shy in settled fruiting-habit.

Premier.--Poor growth of tree, not suited in any way.

Ranelagh. Grafted in 1925. Very poor trees; sparse growth, long-jointed in leaders, and not furnished. Does not promise at all well.

Salome.--Good growth; very robust tree, well furnished, and very fruitful. Suitable to locality.

Scarlet Pearmain. Tree of indifferent growth. Very fruitful, though not to be recommended, as indications are that the tree stagnates after carrying a few crops.

Senator.--Very strong wood-growth, both in stability and height. Very shy in fruiting, and soft in what few fruits are produced.

Shoreland Queen. --Grafted in 1925. Very poor; nothing to recommend planting.

Shepherd's Perfection.--Grafted in 1925. Good growth of very light stability; no crop yet. Does not appear well suited.

Simmonds Winter.--Good robust tree, shy bearer; fruit of poor quality.

Stayman's Winesap.--Trees of great stature and stability, well furnished, and highly fruitful. Well suited to the district.

Statesman.--Medium trees, very upright growth, sparsely furnished; not well suited.

Sturmer.--Very poor growth; fruitful, but not suited to the district.

Tasma. --This variety is not well suited; poor in growth, and in no way desirable.

Washington.--Well suited to the locality; good in every way.

White Winter Pearmain.--Grafted in 1925. Very poor growth of extra-stout wood, very heavy crop. Variety does not appear well suited to locality.

Willie Sharp.---Good growth, but thin in character; fruitful but not exceptionally robust.

Worcester Pearmain.--Poor growth; in no way desirable.

Pears.

All the four varieties of pears under trial were slow in establishing, making very little growth for the first two seasons. Observations are as follows :—

Doyenne du Comice.—Not well suited ; poor trees in every way.

P. Barry.—Trees have grown well ; fair crop ; well suited in every way. To be recommended.

Winter Nehs.—Does not thrive under the local conditions ; poor trees in every way.

Williams Bon Chretien.—Good growth ; strong well-furnished tree ; so far shy in fruiting-habit. To be recommended.

Plums.

In a general way the land and locality are well suited for plum-culture, and indications are that plums could be well and profitably grown. The performance of those varieties under test has been as under :—

Ballena.—Tree not well suited to locality ; nothing to recommend it.

Doris.—Exceptionally strong growth ; well-furnished tree. Good quality of fruit, but medium crops only. To be recommended.

Greengage.—Very poor indeed ; not to be recommended.

Giant Prune.—Very poor growth, does not thrive under the local conditions.

Hermosillac.—Trees did not thrive, and after several years were removed.

Hungarian.—Trees of reasonably good habit and growth ; no fruit so far.

Maynard.—Trees of fair growth only, and very shy in fruiting-habit. Nothing to recommend the variety.

Ngata.—Sturdy tree of good habit and remarkably heavy crop. To be recommended.

Purple King.—Planted in 1926. Tree well suited in every way ; not yet in fruit, but good promise.

Reine Claude de Bavay.—Variety well suited to locality in tree-growth, but very shy in fruiting-habit.

Satsuma.—Variety quite well suited to locality ; tree of good growth and satisfactory crop. To be recommended.

Santa Rosa.—Well suited in every way ; tree quite thrifty and fair crops. To be recommended.

Splendour.—Very heavy growth, well furnished. Desirable tree, but of shy fruiting-habit.

Victoria.—Very poor growth and no fruit. In no way suitable to locality.

Washington.—Tree of very heavy growth and small crop. Not very promising.

Peaches.

Peaches of the more successful varieties proved to be in quite congenial surroundings and have thriven well, with a disposition to rather overluxuriant wood-growth, which may result in a tree of comparatively short life, though their quick establishment and precocity of fruiting would make replacement easy and economic. Observations of varieties under test showed the following results :—

Golden Queen.—A desirable tree in every way ; good sturdy growth, well furnished, and bearing heavy crops.

Hale's Early.—Trees have succeeded well, and are of desirable growth, but crops very poor.

Kia Ora.—Not suited to locality; tree of very poor growth and very shy fruiting-habit.

Mayflower.—A desirable tree, but very shy in fruiting, and for this reason not to be recommended.

Osprey.—Very thrifty tree of good growing habit and heavy crop. To be recommended for planting.

Paragon.—A most desirable variety in every way; robust tree of constant cropping-habit. To be recommended.

Sneed.—Very poor growth and crop, not well suited to the locality.

Nectarines.

The limited number of varieties under test had much the same habit and adaptability as the peaches, and the most suitable ones could be just as confidently planted.

Gold-mine.—Exceptionally well suited and desirable in every way. To be recommended.

Nectarine Cardinal. Tree of poor growth, with fruits of under-size and quality. Not well suited.

Victoria.—Tree of very desirable habit and crop; well suited to locality. To be recommended.

Apricots.

These were most disappointing. Varieties planted were Gooley, Newcastle, Oullin's Early, and Roxburgh Red. None of these were well suited. Little or no growth was made for several years, and the trees languished so far as to justify removal. This test confirms many experiences in the North that apricots do not succeed and are not a commercial proposition.

Summary.

A summary of the results shows that this locality is best suited for apples, plums, peaches, and nectarines in that order of merit, and to a lesser extent pears, while it is inadvisable to undertake the culture of apricots. Varieties which under trial demonstrated their marked suitability are as follows:—

Apples.

Albany Beauty.
Ballarat.
Celo.
Cox's Orange.
Dougherty.
Giant Jenneton.
Gravenstein.
Grannie Smith.
Stayman's Winesap.

Plums.

Doris.
Ngata.
Satsuma.
Santa Rosa.

Peaches.

Golden Queen.
Paragon.
Osprey.

Nectarines.

Gold-mine.
Victoria.

Pears.

P. Barry.
Williams Bon Chretien.

The writer acknowledges with thanks the wholehearted co-operation of Mr. F. G. Long, and his skilled attention to the cultural details of the test.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

OCTOBER is usually a somewhat critical period in the management of pastures. To get the best returns from pastures and from fertilizers which have been applied to them it is essential that the pastures be kept young—that is, characterized by vigorous leafy growth. Such leafy growth is desirable because the nutriment which it contains is in a very digestible form and occurs with the proportions of important ingredients well balanced to meet the requirements of milk-production of the cow and of the ewe.

The length of the period of leafy-growth production is reduced if pastures are allowed to become rank and to run to the development of flowering-stalks. In October in a normally favourable season there is a tendency for the pasture to develop too much growth unless this is properly guarded against. Last season this tendency was most marked on farms where top-dressing had been done for the first time or where the area top-dressed had been extended. On these farms the increased carrying-capacity resulting from the new or the additional top-dressing had been underestimated more often than overestimated, with the consequence that the extra growth could not, during early summer, be satisfactorily utilized by the stock carried, and there was a call for the adoption of practices specially to keep the pasture in check.

Fortunately the practices required for this purpose are definitely known and are in wide use in certain districts. The most important of these is proper handling of the grazing. Instead of allowing the stock to browse over the whole farm they should be concentrated into one paddock for a period sufficiently long to have the growth reduced to such an extent that to keep the stock in that paddock longer would mean that they would suffer. When this stage has been reached the stock should be transferred to another paddock which calls for similar treatment, and then in due course, in a similar way, to other paddocks until all available paddocks have been grazed over or until the growth in the paddock first grazed under this system has reached the stage when again it can be most advantageously grazed. At this stage another cycle of grazing over the paddocks in turn is commenced. If the rate of growth becomes so great that to graze all the paddocks would mean that some of them would become too rank for most advantageous grazing, then a paddock or paddocks providing growth in excess of the grazing-requirements should be dropped from the series of paddocks on which the rotational grazing is being practised. The paddocks so dropped from the rotational grazing series should be shut up for hay or ensilage production, which was referred to in the August *Journal*. Ensilage-making is specially dealt with elsewhere in this issue.

It may be that the growth of the pastures is found to be somewhat in excess of the grazing-requirements of the stock, and yet it is felt that no paddock can be safely dropped out of the grazing programme without submitting to the risk of being somewhat short of feed. A remedy for this position usually lies in further subdivision; often half a paddock could be dropped without risk when a whole paddock could not. Another remedy is to run the mower over any fields in which the whole or patches of the growth have run towards flower-head development. This is a practice which is known as "topping" the pastures, and in some districts into which it has been introduced only within comparatively recent times the

tendency is to delay the topping until it is far too late to obtain from it the full valuable effect it may have in prolonging the period of desirable young leafy production.

While the need for topping may occur on any fields which have not been sufficiently grazed, it is much more likely to occur on those which also have not been adequately harrowed. Indeed, on the latter, because of the development of rank, undesirable, unrelished growth round undisturbed animal-droppings, topping may be advisable even when grazing of the bulk of the field is reasonably close. Often when the topping is done at the right time, the bulk of the mown material which results is so small as not to justify gathering the material for hay or ensilage. It will be found that the wilting which such material undergoes after mowing results in the stock eating it much more readily than would be the case if it were not mown. Such wilted material may be utilized in this way, and with especial advantage if dry stock are available for so utilizing it. As yet farmers in general do not at all fully realize the need for preventing pastures becoming so mature that they pass beyond the vigorous fresh leafy non-woody stage which is so essential for the milk-production which is the foundation of the dairy and fat-lamb industries. The result is that at times farmers have plenty of feed on their pastures and yet their stock are suffering from lack of nourishment. The explanation lies in the fact that the feed available is not the kind required for the achievement of the purpose for which the stock is being kept. For instance, last season a herd was found to be unduly falling off in butterfat-production at the end of October although it was up to its knees in feed—the feed was already beyond the stage of maturity suited for milk-production. Such an instance is mentioned merely to illustrate the importance of attending to methods of grassland-management which assist in keeping the pastures young.

Fields which are to be used for hay-production this season and which have not as yet been shut up should be thoroughly harrowed after the final grazing before shutting up.

FORAGE CROPS.

The spread of knowledge of better methods of pasture-management and the more general adoption of these better methods have made many farmers less dependent than they had been upon special forage crops for their stock-feed requirements. In farming, as in other spheres, there are likely to arise tendencies to go from one extreme to the other, and instances come under notice which suggest that farmers at times go to extremes in the extent to which they depend upon their pastures alone and discard the assistance to the pastures which they could obtain from suitable special forage crops. By suitably using forage crops with pastures, often it would be possible to make the amount of feed available from month to month throughout a season conform better with the stock-feed requirements from month to month than is possible with well-managed pastures alone.

The cost of producing the better conformity which would result in this connection from suitable use of forage crops is the crux of the matter. Each farm has its own special features which must be considered, and so it is impossible to lay down rules which can be applied universally. However, two rules which are of fairly general application are of importance. In the first place, unless all the pastures of the farm are linked to such circumstances that it would be impossible to effect economic improvement by ploughing, then there is a strong probability that special forage crops will be well justified for some time. In the second place, if production of forage crops calls for no material increase in cost of labour or outlay in equipment over that required for ordinary farm routine work, then it is probable that production of appropriate forage crops is desirable. For instance, if a farmer can grow a few acres of forage crops, such as soft

turnips and mangels, mainly with the labour and equipment already on the farm, this fact is highly suggestive that such forage crops would be well worth while.

From these considerations it is clear that good pastures and pasture-management do not necessarily mean that forage crops fall in importance. Indeed, both in sheep-farming and in dairying, some of those who are most efficient as grassland farmers utilize forage crops to an important extent to assist towards the better utilization of their pastures.

Certain factors that beget ultimate success with forage crops require to be considered in October or soon afterwards. Important ones among these are:—

(1) Good cultivation is essential for a full measure of success with forage crops. Good seed, good land, and liberal use of high-grade fertilizers will be to some extent wasted if not linked with thorough cultivation. The extensive farm competitions in Taranaki have taught a valuable lesson in this respect which might well be taken to heart by all. During October much valuable preparatory cultivation can be carried out, weather permitting, which will tend to bring about the desirable good tilth that should be secured before seed is sown. On ground that is too wet, however, it is well to delay cultivation until drying has taken place, this applying in particular to heavy ground. If the soil readily clings to implements or to one's boots when walking over it, this may be taken as an indication that it is too wet to work without doing it harm. Deep as well as thorough cultivation of the seed-bed is essential; if the soil is not cultivated deeply unfavourable conditions which may occur later on will be felt with greater severity.

(2) Earlier crops, which are relatively low in yield, are at times more desirable than heavier ones later on. For instance, a 20-ton-per-acre crop of turnips available to the dairy-farmer early in January may be more valuable than a 30-ton crop later on. Because of the special value of early crops at times it is occasionally advisable to sow a portion of a crop ahead of the time which is best for sowing from the viewpoint of yield and is therefore the season for sowing the main crop. For example, a first sowing of soft turnips and of rape can often be made with advantage in October, although the main crop would not be sown until November. When an early crop of soft turnips is desired a quickly maturing variety such as Red Paragon should be used at the first sowing.

(3) When crops are at their best for forage purposes only for a relatively short period, as, for instance, maize, millet, or cereals for green feed, then such crops, if it is desired to use them over a comparatively long period, should not be sown in one block. Rather a number of sowings should be made at suitable intervals, so that a succession of areas will come to the best stage for use at different dates during the period when the crop is required.

(4) With the increasing proportion of high-class permanent pasture which is becoming a feature of many farms, it becomes desirable to get as much growth as possible from the limited areas which it is deemed desirable to put under the plough for forage-crop purposes. On many farms now when land is ploughed the primary purpose is not, as was often the case in the past, to renovate pasture with the forage crop as a subsidiary consideration and a step towards a return to pasture. The primary purpose is the forage crop, and if this is kept in mind it becomes clear that every measure which profitably fosters high yield should be adopted in order to lessen the amount of ground it is necessary to break out of pasture. This means that liberal fertilizing and high-class seed, as well as the thorough cultivation already mentioned, are features to-day of successful forage-crop production.

—R. P. Connell, M.A., *Fields Division, Palmerston North.*

GUARDING AGAINST LOSSES OF LAMBS.

Every spring a good many losses occur among lambs, and these to a considerable extent can be avoided by the exercise of the best care and management.

First of all there is the trouble commonly known as "pulpy kidney," the victims of which are nearly always the best and fattest of the lambs, which die suddenly at from two to four weeks of age—most often between three and four weeks. At this age the lamb's supply of milk is being augmented by young grass with a high food value. As a consequence the lamb is actually receiving more food at this age than its internal organs can effectively deal with. The lambs die very suddenly, as a rule, without showing any previous symptoms. Therefore, such preventive measures as are practicable require to be adopted if losses are to be reduced as far as possible.

The exercise involved in yarding up the lambs and the loss of blood from marking are as a rule measures which largely prevent this trouble. As the critical period depends on the age of the lamb, and this period is at the age of two to four weeks, exercise daily on a bare paddock is recommended during this period. It is often sufficient in small flocks to move the sheep from one end of the paddock to the other two or three times daily; but, however it is done, plenty of exercise is a most valuable precautionary measure.

A few lambs are lost annually from hæmorrhage, and from infection of the wounds at time of docking and marking. To prevent this any lamb found bleeding excessively after the operating should be again caught and the bleeding stump cauterized, but this should only be done when the bleeding is noticed to be excessive and prolonged. The losses from infection of the wounds caused by the operations can largely be prevented by using only a knife which has been sterilized by boiling water, and swabbing the wounds afterwards with a solution of some reliable antiseptic. A quantity of this should be within easy reach while the docking operations are being carried out.

Another cause of loss among lambs, the direct importance of which is apt to be overlooked or underestimated, is the mis-mothering of lambs at docking-time. Among small flocks this may not amount to much, but on bigger properties it must cause a considerable loss in the aggregate. To prevent this, or to reduce it to a minimum, is a matter involving principally method and management in handling the ewes and lambs at the time of the operation, but every sheep-farmer should bear this point in mind.

—*Live-stock Division.*

THE ORCHARD.

CULTIVATION.

With pruning finished, cultivation commences as soon as the weather and the state of the land will permit. So much depends on good soil-conditions that it is only in exceptional cases that cultivation can be dispensed with for a time. To ease up in cultivation is perhaps the most wasteful practice in all farming operations, leading as it does to increased outlay in manures to supply what should have been stimulated by soil-aeration, to decreased returns due to loss of moisture checking development of fruit and wood, and to increased difficulty in controlling pests which breed in the weeds or in the undisturbed soil. The season during which cultivation can be done in the average orchard is so short that every opportunity should be taken to push on with this work. After the winter rains the surface will be more or less compacted, and in this condition the action of beneficial nitrifying bacteria is retarded. In producing and maintaining

a fine tilth greater oxygen-supplies are incorporated with the soil to the benefit of the trees and soil bacteria to which we are indebted for our fertility, the soil warms up earlier, and the growing season is lengthened. If the top few inches of soil are disturbed frequently the capillary passages through which moisture escapes will be broken, a covering or blanket of small soil-particles and still air is formed over the undisturbed area in which the roots are feeding, and the consequent accumulation becomes available for the tree's requirements. For economic working, the maximum amount of hand-work should be eliminated, and with this end in view all low limbs which interfere with cultivation should be pruned to enable the implements to be worked as close to the trunks as the roots will allow, for the quantity of fruit produced on these limbs will seldom compensate for the hand labour they entail.

The application of manure should not be further delayed.

SPRAYING.

With the advent of warmer weather the activities of orchard diseases increase and close adherence to the spray programme becomes imperative. No programme can be made applicable to all districts, and variations should be made to suit individual requirements. It is in this that the value of a diary is appreciated, and a record of the salient points of one season's spraying may make the difference between failure and success in the next season's operations.

In districts where black-spot is troublesome apples should receive one or sometimes two sprays prior to blossoming. The first is either lime-sulphur 1-10 or 1-15, or bordeaux 0-5-50, at green-tip and up to tight-cluster. The second application is usually lime-sulphur 1-40, when the flower-buds are showing pink on apples and tender varieties of pears; other pears may need a bordeaux 3-1-50 spray.

The next spray is due when the majority of the petals have fallen, and marks the commencement of codlin-moth control as well as being most important for fungoid diseases. Most varieties of apples may receive lime-sulphur 1-100, plus arsenate of lead $1\frac{1}{2}$ lb. if in powder form or 3 lb. if in paste, Black Leaf 40, 1 pint milk of lime from lime equal in weight to the lead and spreader. Tender varieties of apples, such as Cox's, Dunn's, Jonathan, and Golden Russet, should have the lime-sulphur reduced to $\frac{1}{2}$ or $\frac{3}{4}$ gallon per 100 and 4 lb. to 6 lb. of precipitated sulphur added. Some growers prefer dispensing with lime-sulphur and using precipitated sulphur, 10 lb. or 12 lb. per 100, and where trees are not vigorous this is a much safer spray. "Dry-mix" sulphur spray is increasing in favour with commercial growers, but where only small quantities are used it will probably be found cheaper to use one of the other forms of sulphur.

The arsenate of lead is a most important ingredient in the combined spray referred to, and delay in making the first application will be evident throughout the season. In an average season codlin-moth is probably the easiest pest to control, and a bad infestation, although usually attributed to inferior spray material, may be regarded as an indication of slipshod work or failing to apply the spray at the proper time. In the usual life-cycle of the moth the female is depositing her eggs during the blossoming-period, and if the necessary quantity of arsenate of lead is not waiting when the grub is hatched the latter soon buries itself safely in the young fruit. The approximate date of emergence of the moth may be ascertained by making frequent inspections under the old bark or in sheltered crevices in the trees for the silky white cocoons, and noting the development. They may be found in surprising numbers even in well-tended orchards. Given suitable weather conditions, laying commences within a few days after emergence, and the average time required for the eggs to hatch is approximately eleven days. As the emergence of all the first

flight of adults is not simultaneous the laying season may extend over a considerable period, and it is essential that a coating of spray should be kept on the fruit in readiness for each grub as it hatches.

When black aphid appears any affected trees should be sprayed with Black Leaf 40, 1 part to 800, with the addition of a little soap to improve the spread and increase the adhesiveness.

Spraying for brown-rot control will be continued when the blossoms are showing pink, using lime-sulphur 1-50. At petal-fall an application of self-boiled lime-sulphur, dry-mix, or other precipitated sulphur should be made and continued throughout the season, particularly when humid conditions prevail or after rain.

GRAFTING.

Grafting should be completed immediately. If delayed until the sap-flow in the stock is strong the best results are not always obtained, the dormant scions appearing to be drowned by the excessive supply. If the trees or scions are too far advanced for grafting, the trees may be cut down to the required height and left until the young growths have developed sufficiently to bud some time during summer.

Citrus-culture.

During the ensuing period cultivation and the annual overhaul of trees will receive first consideration. If weak bushy growth, which usually produces low-grade fruit, is allowed to remain in the centre of the trees, picking operations are interfered with, and there is always the temptation to do a little thinning while picking, thus interfering with routine work. If the thinning or pruning is done early the light growths are buried with the first ploughing and add humus to the soil, instead of remaining on the surface as a nuisance for a great part of the year if not picked up. In thinning care should be taken to avoid exposing hitherto sheltered bark to too great an extent, as this is liable to lead to sunburn and the consequent loss of limbs. Where ends of shoots have died back, due to frost injury or disease, a little discrimination in pruning will often avoid the bunched conditions of unsatisfactory growth consequent on injuries of this nature. If allowed to grow unchecked lemons are prone to develop an outer fringe of fairly dense growth, which chokes the inside wood and limits the fruit-carrying capacity. The best fruiting-wood is the crooked more or less horizontal shoots, and in pruning the vigorous upright growths should be removed or shortened to a suitable length to induce branching. If the outer growth is kept reasonably open the main limbs can be kept clothed with good fruiting-wood, but if the trees become dense this is soon rendered useless.

Ploughing should be completed before the surface dries out, otherwise the trees may be severely checked by disturbing or exposing the shallow roots. As citrus-trees have a shallow-rooting habit, all the surface under the trees should be frequently stirred to check the development of shallow roots and induce deeper action. This is a matter of some importance, for where cultivation is neglected wilting of the leaves or partial defoliation of the tree may occur during a dry season, resulting in loss of the succeeding crop.

Freshly planted trees are benefited by protection from sun and wind during the first summer. In exposed positions the usual method is to surround the tree with scrim or sacking supported by three stakes driven into the ground about 18 in. from the stem. In sheltered positions light brushy manuka or similar growth driven into the ground and tied together at the top affords useful protection.

Manuring can be proceeded with after ploughing and before disking or harrowing. For healthy trees which require something more in the nature

of general nourishment to maintain production than an active stimulant, blood-and-bone at the rate of about 4 lb. to 6 lb. according to the age of the tree will generally prove satisfactory. Trees which through heavy cropping or lack of cultivation have ceased to produce a satisfactory quantity of young wood and have turned yellow should be stimulated with nitrates. The soil should be worked and a small dressing of nitrate of soda or sulphate of ammonia applied as soon as growth commences, to be followed later by superphosphate or a complete manure. Where procurable, sheep-manure and dags make an excellent dressing, which can be applied as mulch during the summer and later ploughed under. Citrus-trees prefer their nitrogen in a bulky form, and any wool pieces in the manure improve the physical condition of the soil.

Where required for the control of scale insects and the removal of sooty mould or *Capnodium* from the foliage, spraying with oil emulsion 1-40 should be done when the young shoots have attained a length of about 3 or 4 in., followed by a second application about three weeks later if necessary. Spraying before the growth has commenced may result in serious defoliation. Where red scale is present oil spraying should receive particular attention to prevent serious injury to the tree.

To reduce the strain on the trees and check the production of coarse thick-skinned fruit all lemons should be harvested as soon as they are ready. For home use where only a small quantity of fruit is concerned it can be kept for months if carefully gathered and stored in a dry place and protected from strong draughts. Lightly smearing the fruit with vaseline will be an assistance, as also is covering the fruit in the cases with perfectly dry sand.

—G. H. McIndoe, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CARE OF THE GROWING STOCK.

LATE-HATCHED chickens under ordinary circumstances are placed in stale quarters and runs, and have not the protection from hot weather which nature demands, but which chickens hatched at a cooler period do not require. The disadvantages of late hatching can be counteracted to a great extent by placing the chickens in a clean fresh run which has the advantage of being well shaded. It is a mistake to conclude that when the young birds have passed the brooder stage they may be left to scratch for their living, and to generally looked after themselves. It is at this time, indeed, that they demand every favourable condition if they are to develop to the best advantage. Too often they are turned into old quarters or some unsatisfactory building, with no proper provision for cooling off, because all the good houses are occupied by adult stock.

Not only should provision be made for thoroughly clean houses and runs for the growing birds, but, in addition, some hover arrangement should be provided which will give them the desired seclusion to which they have been accustomed. In this way the chickens will be discouraged from huddling in corners, as they invariably do if taken direct from a brooder to an open-fronted house where no special sleeping-quarters are provided. Huddling should be prevented at all costs, as the sweating thereby induced is a common cause of chill, and inevitable mortality. A good sleeping arrangement can be made by having the perches, three or four in number, arranged, say, 1 ft. from the ground, and a similar distance apart. These should be covered with grain-sacks, but care should be taken to keep the ends of the sacks about 3 in. above

ground-level to enable the chickens to secure the necessary fresh air. After the first few days, and as the chickens grow older, the spaces between the sacks should be gradually opened wider as a means of allowing any bad air to escape, and at the same time of effecting the hardening-off process by degrees. Care should be taken for the first night or two to see that the chickens go under the hover, and do not crowd in corners, as it is unusual for them to take shelter on their own account. Trouble may be minimized in this respect if the chickens are placed under the hover when it is dark. The corners of the house should be rounded off with fine-mesh wire netting, so that in the event of the chickens finding their way to the corners they will be prevented from crowding against the walls, which is often responsible for heavy mortality taking place. For bedding dry straw or chaff may be used. Grass hay should not be used for bedding down chickens of any age, as this is apt to heat and bring about a sweated condition. It is extremely important that chickens should not be compelled to sleep under damp or moist conditions.

A common trouble which usually affects chickens after they leave the heated brooder is an inflammation of the veins. It first makes its appearance in the hock-joints, which become discoloured, followed by a gangrenous swelling. In a few days the wings become affected in a similar manner, and later the neck and head swell. At this stage death is not far off. There is no cure for this trouble. It is merely a question of prevention by avoiding overcrowding, providing ample ventilation, keeping the quarters clean and dry, and, above all, checking everything that tends to create a moist atmosphere. In order to prevent dampness as far as possible, it is a good plan to place under the bedding-material a piece of ruberoid or similar material until such time as the chickens take to the perches.

Where possible the growing birds should be given a good range, as confined or hothouse-plant conditions do not tend to promote the development of healthy and robust stock. There is no better place for them than an orchard. Of course, reference is now made only to the young pullets and cockerels intended for future breeding purposes. Cockerels intended for the table should have their exercise curtailed, as a free range does not tend towards rapid flesh-formation.

It is important that the sexes be separated at an early age, and the cockerels removed before they commence to crow. This will be to the advantage of the pullets, and will enable the cockerels to attain a desirable table condition earlier. The aim of the poultry-keeper should be to raise only vigorous stock. Good feeding, absolute cleanliness, and an ample supply of greenstuff, grit, and clean water are essentials to this end.

CANNIBALISTIC HABITS IN CHICKENS.

Almost daily I am being asked by correspondents for advice regarding chickens pecking each other. The cause of this trouble is difficult to determine, as it is common for the young birds to acquire the habit even when they are provided with good conditions and are under good management. The trouble may be minimized by giving the chickens pieces of tough meat to keep them running about. This, however, must be provided daily or not at all, for if they once acquire the taste for animal food and it is not available they are apt to crave for it, and as a result resort to pecking each other. When a regular supply of meat is not available it is a good plan to have a high-grade brand of meat-meal in front of the birds at all times for them to peck at during the brooder stage. As a further preventive of this trouble the chickens should be induced to exercise as much as possible by the provision of large-sized runs, or by making them scratch in fairly deep litter for their grain ration. An abundance of succulent green material will also do much towards minimizing cannibalistic

inclinations. The trouble is probably most common during bad-weather conditions, when the chickens have to be confined to the house. Especially does this apply where they have been accustomed to a run out-of-doors. At such a time the chickens will be discouraged from acquiring the habit if the open part at the front of the house is covered with some sort of curtain, in order that these quarters may be kept more or less in a state of semi-darkness. Generally it is the root of the tail and also the toes that are pecked at, and once blood makes its appearance from these parts the victim is apt to die a cruel death unless it is isolated from its mates. Sometimes the removal of the victim from the flock can be avoided by a light application of Stockholm tar to the affected parts, which will discourage its mates making further attacks. As is the case with practically all other troubles affecting chickens, prevention is the only real means of dealing with this one, and plenty of range as a means of inducing the birds to exercise is probably the chief essential.

--F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SEASONAL PREPARATIONS.

OCTOBER is perhaps the month when the apiarist can do most in helping his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the Southern districts they will probably not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. Yet, on the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examination can settle the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of disease which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost suicidal for the beekeeper to treat his bees in October; in others, where right conditions prevail, it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to ensure that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding.

HIVING SWARMS.

In most text-books on beekeeping this kind of advice is given. "When a swarm settles into a cluster take a light box and shake the bees into it," &c. This advice is all right where the bees are accommodating enough to settle in a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box with the brush which is used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise the probabilities are that before the close of the day the box will be taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

WATER-SUPPLY.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing a drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

TOMATOES AND SMALL FRUITS.

TOMATOES under glass will now be setting the lower bunches of fruit, and liquid manure may be given. Temperatures should be maintained, but high temperatures in bright weather are injurious unless ample ventilation is given. This is of special importance in Northern districts where mould fungus is prevalent. Any cultivation necessary now should be very shallow to avoid disturbing the roots. Suckering and training the plants will require close attention.

Plants for the outdoor crop should be making steady growth, and should be given more air in fine weather. Towards the end of the month they should be placed outside in scrim-covered cradles to be hardened off. This should be done with careful consideration of the weather conditions at the time, so that the plants do not receive a check. Negligence in this connection is a very common fault: the plants become blue and starved and take a long time to recover. With hardly any exception, plants at this stage would receive benefit from one or two applications of bordeaux spray for the prevention of fungus disease. The preparation of the land in which the young plants are to be grown should now be completed.

Egg-plants and peppers are rather more susceptible to low temperatures, and the plants should be grown on under glass, and prepared for planting out a week or two later than tomatoes.

As the strawberry-beds come into flower a dressing of nitrate of soda or sulphate of ammonia, 1 oz. to the square yard, will be beneficial. This is an attention from which most other kinds of small fruits would benefit at this stage. After working in the manure the strawberry-beds should be given a mulch of straw or such other material as may be available.

THE MARKET-GARDEN.

Thinning seedling crops and cultivation with the Dutch hoe in bright weather are operations of the first importance at the present season.

Cabbage, cauliflower, and lettuce plants recently set out should receive a dressing of nitrate of soda as soon as they are established; this may be repeated three or four weeks later.

As the winter crops of cabbage, broccoli, &c., are cleared, the ground should be prepared for the half-hardy crops of tomatoes, egg-plants, peppers, cucumbers, melons, marrows, pumpkins, and dwarf and runner beans. Many of these are sometimes raised in boxes under glass and pricked out into pots or punnets, so as to be well forward by the time for planting them out arrives. This method is a very valuable aid to early cropping.

There is an increasing demand for well-grown beetroot. The main crop should now be sown.

The early crops of potatoes, peas, &c., will be cleared during the month of December, and the land will then be available for autumn and winter crops of savoy, cauliflower, broccoli, leeks, and celery. In preparation for this planting seed-beds should now be sown. Sow thinly in good rich soil that will induce steady growth. Celery is usually raised in boxes and pricked out 2 in. apart. This plant is best raised in partial shade, and large quantities may be sown in drills in the open. In this case the plants should be wrenched a week or two before lifting them for planting out, by cutting the tap-roots 2 in. or so beneath the surface. In this manner fibrous roots are formed and the operation of transplanting is facilitated. For commercial purposes the Golden Self-blanching variety is the most profitable.

LAWNS AND GREENS.

Lawns and greens from now on will be making rapid growth, and will require mowing frequently to keep the turf in condition. Good well-mown lawns are one of the most pleasant and attractive features in a garden, and for a couple of months they will require regular attention in this respect if they are to look their best. For this work a sharp clean machine is necessary, and it should be properly set; every gardener should thoroughly understand the working and setting of this machine. It may be sharpened by turning it over, reversing the action of the cutting-cylinder, and feeding in emery powder and oil with a cloth as the cylinder is turned on the bed-plate. This has the effect of sharpening the knives on the cylinder as

well as the edge of the bed-plate, and maintains a proper adjustment. When sharpened the machine should be wiped clean and the gears replaced as before.

Tobacco-culture.

Although it is not advisable to take any great risks by putting tobacco-plants out in the field too soon, yet in order to economize harvesting and curing costs it is often desired to spread those operations over the full harvest period especially where large crops as related to the equipment are concerned. To do this one must spread the *planting-period* instead of planting the whole crop at one time, in doing this early planting is preferable to planting out very late. In some well-drained and sheltered situations in the warmer districts a commencement may often be made during the month of October, and for this work both the plant-beds and the field will require some further preparation

It is assumed that at this period the land has been deeply cultivated without bringing the subsoil to the top, and that frequent harrowing during the spring has destroyed seedling weeds, also that dressings of lime and fertilizers have been made and worked in. The further preparation for planting consists of levelling and smoothing the surface with a plant-drag, which will greatly facilitate the planting and other operations which follow. As cut-worms are sometimes a great pest to young plants, which are eaten off by these hungry larvæ whose natural food-plants have been destroyed, it is sometimes necessary to broadcast a poison bait to destroy them. The danger is greatest where grasslands have been broken in, and especially where the preparation has been late and quickly done. In such cases the bait should be broadcast a few days before planting, and towards the end of an afternoon, as these caterpillars chiefly feed at night. The bait is made of 1 lb. Paris green, 3 lb. treacle, and 1 bushel bran. Boil the Paris green in 1 gallon of water, pour the treacle into the boiling mixture, and stir well; then take it off the fire. Damp the bran with a little water, add it to the mixture, and stir well until all the ingredients are thoroughly distributed. Arsenate of lead, 2 lb., may be used instead of Paris green. This quantity is sufficient for 1 acre. It should be broadcast thinly in fine weather, and should rain interfere with its action the application must be repeated.

The further preparation of the early seed-beds previous to transplanting will consist of treatment with a view to hardening off the plants gradually without checking the growth. This may be done by removing the covers for an hour or two each morning, gradually lengthening the period until the plants are exposed all day, the covers being only replaced during the night. During this operation the plants should be kept on the dry side and only watered to prevent them wilting. The day before transplanting is commenced the bed should be well watered to enable the plants to be removed with as little damage as possible. The plants should be lifted with plenty of soil, and stood upright in trays for removal to the field. A good "take" in the field largely depends on the care given in hardening and transplanting the plants.

When planting out, the rows should be made in a north-and-south direction 4 ft. apart to allow room for working. An average distance between the plants is 2 ft., but this should be adjusted to suit the land; on a fertile soil they may be rather closer, to prevent the leaves growing coarse and rank. At the distances given it takes 5,000 plants to plant an acre. The usual method of planting is to strike out a furrow about 3 in. to 4 in. deep with a small hand-plough, using rods 4 ft. in length to indicate the line. As these rods are approached by the plough they are removed, the distance is measured, and the rod placed in position for the next line 4 ft. away. The planters follow and place each plant in the

furrow, and cover them firmly by drawing back the soil by hand. On the return trip of the plough the filling of the furrow is completed. The plants should be planted deeply and firmly, with the terminal bud slightly below the level of the soil, taking care that soil does not get into the bud of the plant.

No amount of care can compensate for a bad take at first setting, but to replace losses it is customary to plant every eighth row with plants 1 ft. apart. Then where gaps occur a hole is dug, and a spare plant is lifted with a shovel and set in the place with little damage. This method keeps the plants in the field as even as possible, which is most desirable, as an uneven crop is difficult to harvest properly. Replacement should not be made later than ten to fourteen days after planting, at which period the extra plants should be destroyed.

—W. C. Hyde, *Horticulturist*, Wellington.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1928-29.

Dairy Division

LISTS of butter and cheese factories which have obtained for their export produce an average grade of 93 points or over for the past dairy-industry year—1st August, 1928, to 31st July, 1929—are here presented. Seventy-five butter-factories and thirty cheese-factories have gained a place in the lists this year, compared with sixty-nine and twenty respectively for 1927-28. The highest butter average this year is 95.112 points, as against 95.039 in the preceding year. The top cheese average is 94.473 points, compared with 93.755 in 1927-28.

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Butter-factories.			
Taiari and Peninsula (Dunedin)	54	Taiari and Peninsula	95.412
Rangitikei	1360	Rangitikei	95.189
Rata	938	Rata	95.023
Levin	910	Lake	94.867
Wangaeahu	1326	Wangaeahu	94.832
Awahuri	664	Red Rose	94.707
Moa Farmers'	341	Inglewood	94.703
Golden Bay	146	Sovereign	94.632
Mangorei	345	Mangorei	94.520
Rongotea	8	Rongotea	94.473
Waitaki	812	Waitaki	94.350
United	1220	Whariti	94.336
Farmers' Dairy Federation (Invercargill)	336	Murihuku	94.335
Maketawa	342	M.D.C.	94.321
Shannon	1489	Shannon	94.291
Taiari and Peninsula (Oamaru)	1234	Taiari and Peninsula	94.291
Arahura	1516	Arahura	94.262
Midhurst	110	Rugby	94.228
Wairoa	1345	Wairoa	94.144
Tarururangi	728	Champion	94.138
Tolaga Bay	1007	Tolaga Bay	94.104
Tikorangi	102	Shield	94.084
Rangiwahia	750	Quail	94.082

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1928-29—*continued*.

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Butter-factories—<i>continued</i>			
Uruti	300	Uruti	94.003
Lepperton	49	Lepperton	93.983
Kia Ora	926	Kia Ora	93.982
Waitara	726	Waitara	93.936
Kairanga	1768	Longburn	93.935
Invercargill	290	Rakiura	93.925
North Taranaki	723	Flax	93.914
Wellington Municipality	202	Rahui	93.906
New Zealand (Ngatea)	291	Anchor	93.896
Palm	1838	Palmerston	93.891
Farmers' Dairy Federation (Gore)	165	Gore	93.875
Tarata	631	Tarata	93.872
Okau	872	Okau	93.871
Norsewood	600	Norsewood	93.857
Pio Pio	603	Pio Pio	93.794
Cheltenham	3	Pakeha	93.746
Kuku	905	Ohau	93.740
Raetihi	717	Raetihi	93.737
Taihape	1188	Tikapu	93.723
Apiti	414	Apiti	93.712
Kokatahi	1144	Kokatahi	93.666
Tariki	1878	Tariki	93.648
Heretaunga	1230	Heretaunga, Temoe	93.637
Golden Coast	991	Golden Coast	93.614
Omata	82	Omata	93.578
Waipukurau	1455	Mount Vernon	93.518
Napier	169	Clive	93.507
Masterton	1307	Masterton	93.492
West Coast Farmers'	675	Silver Pine	93.446
Inter Wanganui	6	Inter Wanganui	93.408
Ngatiporou	395	Nati	93.400
Ruawai	66	Ruawai	93.378
Tamaki	1463	Tamaki	93.376
Bell Block	488	Bell Block	93.362
Kaikoura	302	Kai	93.351
Katikati	1305	Katikati	93.329
Stratford	68	Stratford	93.300
Murchison	1888	Airship	93.290
Konini	1203	Konini	93.282
Kaponga	732	Kaponga	93.273
Mauriceville	14	Mauriceville	93.225
Waimate	244	Waimate	93.146
Karamea	1570	Karamea	93.145
East Tamaki	301	East Tamaki	93.111
Kiwi	299	Kiwi	93.106
Caroline	236	Caroline	93.097
N.Z. Farmers' Dairy Union	100	Hinemoa	93.096
Kaipara	794	Poplar	93.072
Alpine	792	Pine	93.063
Maungaturoto	1407	Otamatea	93.059
Northern Wairoa	4	Hobson	93.015
Whakaronga	1709	Whakaronga	93.000

Cheese-factories.

Kaiparoro	619	Bruce	94.473
Little Akaloa	32	Little Akaloa	94.154
Milton	1030	Milton	94.099
Omimi	74	Omimi	93.946
Waimana	1817	Waimana	93.931

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1928-29—*continued*.

Company or Proprietor.	Registered No	Brand	Average Grade Points.
Cheese-factories—<i>continued</i>.			
Carrington	621	Carrington	93.769
Woodville	1892	Woodville	93.745
Tamaki	58	Tamaki	93.733
Ryal Bush	477	Ryal Bush	93.653
Barry's Bay	401	Onawe	93.606
Brydone	1821	Brydone	93.566
Dalefield	9	Dalefield	93.548
Tamaki	1463	Tamaki	93.446
Belvedere	486	Belevedere	93.432
Wyndham	50	Wyndham	93.344
Pine Bush	543	Pine Bush	93.328
Taratahi	101	Taratahi	93.287
Hopelands	1178	Hopelands	93.272
Staveley	1719	Staveley	93.222
Momona	1010	Momona	93.215
Royal Oak	693	Royal Oak	93.188
Merton	45	Merton	93.134
Stirling	292	Stirling	93.117
Wright's Bush	206	Wright's Bush	93.116
Seaward Downs	702	Seaward Downs	93.111
Orari	254	Orari	93.093
Takamatua	33	Takamatua	93.073
Maungatua	1708	Maungatua	93.054
Waianiwa	1171	Waianiwa	93.045
Edendale	36	Pioneer	93.041



DOMINION TREASURE LASS (RUAKURA STATE FARM).

C.O.R. in Jersey junior two-year-old class : 11,302 lb. milk, 614.87 lb. butterfat.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FEEDING MOLASSES TO COWS.

“A B.C.,” Dannevirke :—

I have been told that molasses is a good thing to mix with chaff for feeding cows, and should be glad to know the quantity to allow per cow and how to feed it. Would treacle deteriorate with age or develop any poisonous properties through being kept in a barrel for eight or ten years?

The Live-stock Division :—

Molasses is used for cattle, horses, and sheep, but only to a limited extent in New Zealand. As an addition to roughage it is given with the object of inducing the animals to eat the roughage, and especially in cases where the latter is not of the best quality. Molasses may be used with chaff for your cows. It is usual to dilute the molasses with water and spray it over the chaff. The quantity of molasses given per head per day can be gradually increased up to 2 lb. It is advisable, however, to commence with only $\frac{1}{2}$ lb. per head per day until the cows become accustomed to it. It would not be advisable to use treacle which had been stored for such a long period as eight to ten years.

TOP-DRESSING CHEWINGS FESCUE.

D. J. H., Nightcaps :—

Can you give me information of what would be the best artificial manure for top-dressing Chewings fescue to make it throw up an abundance of seed-stalks? The fescue is growing on a stiff clay soil, and is not by any means a thick or close sward.

The Fields Division :—

It is rather doubtful if the application of manures to Chewings fescue would result in a payable increase. Usually a Chewings fescue pasture represents a certain soil fertility level much lower than that required for other pasture grasses, with perhaps the exception of ratstail and some of the danthonias. When manures are applied, the response is rather from higher-fertility-demanding grasses, clovers, &c. In a Chewings fescue pasture at Mossburn, top-dressed with 3 cwt per acre of super, the increase from grass-growth was only slight, by no means payable, and such increase was mainly fog, crested dogstail, and suckling clover. If there is a fair clover content in your Chewings fescue the super, &c., would increase this rather than the Chewings fescue, give you more bulk to deal with, and it is very doubtful if the Chewings fescue increase would compensate you. If you are depending on grazing from the Chewings fescue aftermath, then it might be worth while, but rejuvenation by the plough when the Chewings fescue is running out is perhaps the best method.

WHITE TONGUE AND MARKINGS IN JERSEY CATTLE.

“GRATEFUL,” Woodside :—

I have a purebred Jersey bull which is entered in the stud book, a beautiful animal in every detail, but with a white tongue. Is this a mark of degeneracy? The bull also has a white mark on the brisket. Has this any connection with the white tongue?

The Live-stock Division :—

White markings on the hair of purebred Jersey cattle are quite common, and so also are white tongues. Many of the purebreds in the Island of Jersey are thus marked, and judges here take no objection to them.

GROWING LUPINS FOR GREEN MANURING AND SEED.

"LUPIN," Awatata :—

I would like some information about the growing of lupins, both for seed and for green manuring. What time of the year they should be sown in Southland? Would a stiff clay soil suit them—say, after turnips were fed off? What manure should be used?

The Fields Division :—

Blue lupins will do excellently on clay soils. They should be sown in 7 in drills at a depth of $1\frac{1}{2}$ in to 2 in. For green-manuring purposes lupins can be sown in Southland early in October. They commence to flower in about eleven or twelve weeks after sowing, and are ready to plough under when the pods are filling, usually a month later. Sow at the rate of $2\frac{1}{2}$ bushels per acre, with 2 cwt to 3 cwt of superphosphate per acre. For a seed crop sowing should be done about the same time as for oats, to ensure harvesting operations being carried out in good weather. Sow at the rate of $1\frac{1}{2}$ bushels per acre in 7 in drills, using the same manure. The crop should be cut with the binder when the top pods are ripe. Stack the crop and allow it to mature for several months before threshing. Any ordinary threshing plant will deal effectively with lupins.

FOOT TROUBLE WITH SHEEP.

J. F. W., Hicks Bay :—

I would be grateful if you could give me a reliable remedy for scald in the feet of sheep. A good number of the ewes were bad in the autumn. I examined all their feet, pared them, &c., and put some of them, along with foot-rotty sheep, through a bath containing a proprietary foot-liquid. All the scalded ones are still bad, though they are running at the tops of my hills. All the foot-rotty ewes are cured.

The Live-stock Division :—

There is no reason to believe that scald is different from foot-rot. Scald in sheep is generally the precursor to foot-rot, or it might be described as a mild form of foot-rot. Scald in the feet is frequently seen when sheep are grazing on rank grass, especially in wet seasons. Rational treatment for this complaint is the application of an astringent solution to harden the hoof, especially the interdigital space. A solution of copper sulphate (bluestone) in water is one of the safest and best astringents to use. If a small number of sheep are affected hand treatment can be carried out, if a number are affected a foot-bath, either wooden or concrete, is more suitable. Bluestone solution can be used at the rate of 4 oz. to 8 oz. to the gallon of water. Depending on the extent of the trouble, the foot should be kept in the solution from three to five minutes.

CULTIVATION OF ARTICHOKEs.

HUGH ROSS, Waitomo Caves :—

Would you please give me particulars in regard to planting Jerusalem artichokes. Do they need deep cultivation? What is the best time for planting, and the right distance apart in the row?

The Fields Division :—

Artichokes do best on deep loams of light to medium texture; on the heavier and wetter types of soil the tubers do not keep well. The land should be ploughed in the late winter and worked up for planting in the spring. The easiest way to plant the tubers is to cross-plough, and plant the tubers in the furrows like potatoes. The tubers should be planted 3 in. deep, in rows 2 ft. to 2 ft. 6 in. apart, and 18 in. to 20 in. apart in the rows. The crop should be fertilized with 3 cwt. to 4 cwt. of superphosphate per acre. Towards the end of September would probably be the best time for planting in your district. Where the tubers planted are small it is best to plant two or three together, but one large tuber gives the best returns. The weight of tubers necessary to plant an acre is 12 cwt. to 15 cwt.

CHOU MOELLIER FOR SHEEP.

"X," Christchurch.—

I hear that chou moellier is largely replacing swedes in Southland. I have seen it growing in small quantities, but would like to know whether it can be fed to sheep other than by hand feeding, and, if so, at what stage of growth? When should it be planted, say, in North Canterbury, for feeding in July and August? How great is the danger of its being blown down by wind?

The Fields Division :—

A considerable area of chou moellier is grown in Southland as feed for both cows and sheep. It requires good land to produce a heavy crop, and takes at least six weeks longer to mature than rape. It can be fed in the same manner as rape or other like crops. If the crop is sown early in December it will be ready for feeding in the late autumn, but will keep in a satisfactory feeding condition until the end of July. The plant has a very strong root-system and is seldom blown down by gales.

PERMITS FOR KEEPING RABBITS.

IN view of the number of Angora and Chinchilla rabbits now kept for industrial purposes, it should be generally known that any person keeping rabbits without a permit is liable to prosecution and a fine of up to £20. Hence, it is advisable for any one at present keeping rabbits without such a permit to communicate immediately with the Inspector of Stock at the nearest office of the Department of Agriculture. Circumstances point to the necessity for the Department enforcing this provision of the Act, and Inspectors throughout the Dominion are being instructed to report upon all cases where any one is found in possession of rabbits without a permit, with a view to legal proceedings being taken where the circumstances are such as to warrant that course.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 25th July to 5th September, 1929, include the following of agricultural interest :—

No. 60492 Manure, C. H. Robbins, Carterton. No. 62247: Hoof cushioning pad; A. V. Downie, Kensington, N.S.W. No. 62538 Manure distributor; A. Storrle, Auckland. No. 62928 Grip for tractor wheel; A. M. McGregor, Parkes, N.S.W. No. 62939 Egg container, J. H. Pickett, Hamilton, Ontario. No. 60332 Support for cast sheep; G. A. Bruce, Oxford. No. 60710 Fibre-handling apparatus; Maddren Bros., Ltd., Christchurch. No. 61138: Gravity grader for fruit, D. Knowles, Motueka. No. 61217 Milking-machine pulsator; H. H. Sutton, Waihi. No. 61468: Machine sheep-shear; J. E. Ellis, Auckland. No. 62638: Milking-machine pulsator; C. A. Martin, Hamilton. No. 62815: Milking-machine releaser; J. Treloar, Hamilton. No. 62990: Snail trap, N. J. Gilbert, Auckland. No. 63130: Hemp bleaching; Spectrum Dyes Pty., Ltd., Melbourne. No. 62134: Horse cover; J. Curry, Riversdale.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

Noxious Weeds Orders.—The Picton Borough Council has declared broom, fennel, and St. John's wort to be noxious weeds within the borough boundaries. The Green Island Borough has similarly declared all plants specified in the Second Schedule of the Noxious Weeds Act, 1928, and Rotorua Borough broom and gorse. The Amuri County Council has declared Californian thistle *not* to be a noxious weed within that county.

WEATHER RECORDS : AUGUST, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THE weather in August was mainly a repetition of the unsettled type experienced during the previous month, with the additional disadvantage of more frequent strong winds, from both northerly and southerly directions. The monotony of unsettled conditions was, however, relieved by three intervals of fine weather associated with well-developed anticyclones. These fine spells covered the periods from the 1st to the 6th, from the 13th to the 15th, and from the 27th to the close of the month.

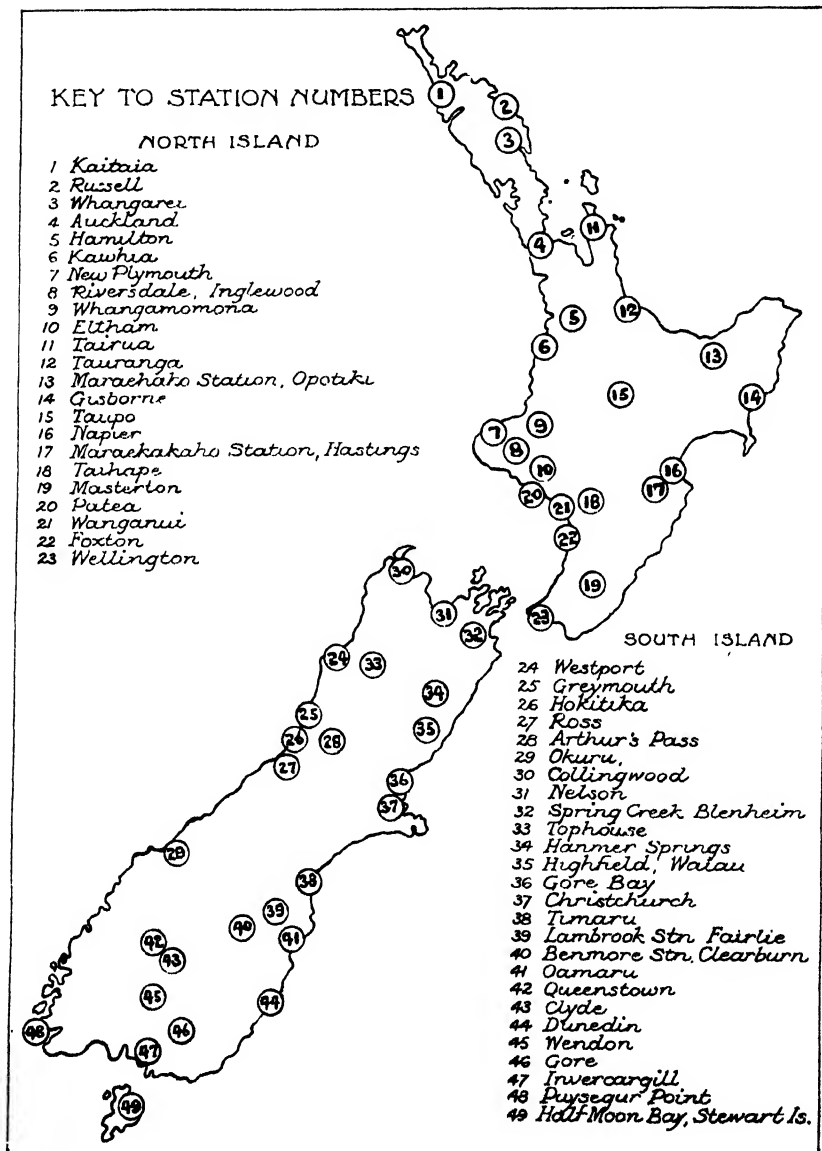
The differences from the average rainfall varied considerably, places in the same districts showing marked departures in opposite directions. For instance, Wellington City had 68 per cent. above the average, but Foxton 35 per cent. below, Timaru 11 per cent. above, and Oamaru 26 per cent. below; Hanmer Springs 138 per cent. above, and Christchurch 33 per cent. below. Westland recorded less than the average, as also did the greater part of Otago and Southland. Queenstown, however, had an excess. The Kaikoura district and the high country of the South Island had considerably more than the average. In the North Island, North Auckland and parts of the Gisborne, Hawke's Bay, and Taranaki districts had less than the normal fall, but the central area and places in the Wellington and Wanganui districts had more.

Temperatures were, on the whole, below normal, owing principally to the prolonged southerly spell from the 20th to the 27th, inclusive. Frosts were unusually numerous. Snowfall was even greater than in July in the mountain ranges of the South Island, and at some of the high-level sheep-stations snow raking had to be resorted to. It is considered that there has not been so great an accumulation of snow in the mountains for about ten years. Although the growth of pasture was retarded somewhat by the cold temperatures it was not altogether checked, for in most districts sunshine was fairly abundant, and while the nights were cold they were compensated for by many mild days. Furthermore, though cold, conditions were seldom severe. Stock have kept in good condition, and lambing averages, so far, have been satisfactory. In some districts, such as the central portion of the North Island, the heavy rain has caused some mortality among the newly born lambs. The cold and wet conditions were detrimental, also, to the milk-supply from dairy herds.

The most generally unsettled weather was that which commenced about the 16th and continued until the 26th. By the 16th an anticyclone which had been covering New Zealand during the previous three days had passed eastwards, and an intense depression of the westerly type followed. During the night of the 16th and on the 17th heavy rain fell in the western districts, and north-west gales of exceptional force were experienced in and south of Cook Strait. Squally and unsettled conditions continued until the 19th. This particular depression contained three deep waves, the last of which passed over the Dominion on the 19th. On the day last mentioned there developed north-west of Cape Maria van Diemen a cyclone which proved to be the first of a series. These cyclones moved from west to east north of New Zealand, the last passing on the 26th. With one of them were associated the southerly gales of the 20th and 21st, during which heavy rain fell in many places in the North Island, and much flooding resulted in the Wairarapa, in parts of the Hutt Valley, and at Miramar.

Another storm, the effects of which, however, were less widespread, was associated with a cyclone which moved on to the North Island on the 7th.

Fairly general rain fell on this occasion, and during the night of the 7th, while the centre of the cyclone moved eastward from Auckland to beyond East Cape, conditions were particularly boisterous in the Hawke's Bay and Gisborne districts. East Cape had a thunderstorm and 5.25 in. of rain during this night.



RAINFALL FOR AUGUST, 1929, AT REPRESENTATIVE STATIONS.

Key No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
<i>North Island.</i>					
		Inches.		Inches	Inches.
1	Kaitiaki	6.07	13	1.45	5.10
2	Russell	3.11	12	0.83	5.55
3	Whangarei	5.37	14	1.27	6.90
4	Auckland	4.89	16	1.22	4.10
5	Hamilton	5.74	14	1.83	4.02
5A	Rotorua	5.80	10	1.07	4.95
6	Kawhia	6.89	16	2.21	4.54
7	New Plymouth	3.13	15	0.51	5.33
8	Riversdale, Inglewood	5.80	17	0.95	8.65
9	Whangamomona	6.22	12	1.43	5.83
10	Eltham	4.61	14	1.02	3.82
11	Tairua	4.20	11	1.40	6.33
12	Tauranga	5.01	13	1.38	4.08
13	Maraehako Station, Opoitiki	6.77	12	2.88	5.20
14	Gisborne	2.68	12	1.20	4.55
15	Taupo	4.24	10	0.07	4.00
16	Napier	2.81	12	0.98	3.57
17	Maraekakaho Station, Hastings	2.70	14	0.94	3.31
18	Taihape	2.92	17	0.02	2.73
19	Masterton	3.84	18	1.07	3.33
20	Patea .. .. .	..	..	..	3.50
21	Wanganui	2.74	12	0.50	2.73
22	Foxton	1.88	7	0.52	2.80
23	Wellington (Karori Reservoir)	6.60	17	2.18	3.97
<i>South Island</i>					
24	Westport	3.06	20	0.53	6.27
25	Greymouth	5.20	12	1.20	7.53
26	Hokitika	6.56	14	1.46	9.34
27	Ross	9.83	10	1.06	10.40
28	Arthur's Pass	14.45	15	5.00	12.78
29	Okuru, Westland	4.76	7	1.54	11.46
30	Collingwood	1.14	5	0.45	6.96
31	Nelson	1.17	8	0.43	3.02
32	Spring Creek, Blenheim .. .. .	..	..	..	2.73
33	Tophouse	5.14	12	0.85	4.04
34	Hanmer Springs	6.01	19	1.32	2.52
35	Highfield, Waiau	4.40	8	1.16	2.26
36	Gore Bay	2.68	6	0.85	2.12
37	Christchurch	1.22	8	0.51	1.83
38	Timaru	1.56	6	0.56	1.41
39	Lambrook Station, Fairlie	3.66	8	1.30	1.43
40	Benmore Station, Clearburn	2.52	10	0.88	1.45
41	Oamaru	1.27	6	0.46	1.71
42	Queenstown	3.43	11	1.30	1.93
43	Clyde	0.50	7	0.20	0.80
44	Dunedin	0.98	13	0.22	3.14
45	Wendon	1.03	7	0.50	2.26
46	Gore	1.65	15	0.56	2.31
47	Invercargill	2.86	15	0.50	3.31
48	Puysegur Point	5.43	21	0.61	7.20
49	Half-moon Bay	5.29	22	0.86	4.35

—Edward Kidson, Director of Meteorological Services,
Wellington, 6th September, 1929.

CERTIFICATES ISSUED FOR SEED POTATOES.

FOLLOWING is a list of growers whose crops have been subjected to and passed the tuber inspection in connection with the system of Government certification of seed potatoes, during the month of August. A previous list was published in last month's *Journal*.

					Acreage.
<i>Bresee's Prolific</i> —	James Carr, Mount Hutt, R.M.D., Rakaia	..	..	..	2
<i>Endurance</i> —	R. G. Bishop, R.M.D., Southbridge	..	..	..	1
	W. J. Bishop, "Rosedale," Southbridge	..	..	..	1
<i>Dakota</i> —	James Carr, Mount Hutt, R.M.D., Rakaia	..	..	..	1
	Doak Bros., West Belt, Rangiora	..	..	..	12
	P. J. Gill, P.O. Box 11, Kirwee	..	..	..	1
<i>Arran Chief</i> —	F. A. Rollinson and Sons, Studholme Junction	..	..	..	18
<i>Golden Wonder</i> —	S. Kokay, Tuatapere	..	..	..	2½
<i>King Edward</i> —	R. Knibbs, McNab, via Gore	..	..	..	1
<i>Up-to-date</i> —	P. J. Gill, P.O. Box 11, Kirwee	..	..	..	1
<i>Auckland's Short-top</i>	J. Rouse, Pareora	..	..	..	1

AGRICULTURAL SHOWS, SEASON 1929-30.

THE following show-dates have been notified by agricultural and pastoral associations --

Hawke's Bay A. and P. Society. Tomoana, 16th and 17th October, 1929.

Poverty Bay A. and P. Association: Jubilee Show, Gisborne, 22nd and 23rd October.

Wairarapa A. and P. Society. Carterton, 23rd and 24th October

Timaru A. and P. Association. Timaru, 30th and 31st October

Manawatu A. and P. Association. Palmerston North, 5th, 6th, and 7th November.

Northern A. and P. Association: Rangiora, 8th November.

Wanganui A. and P. Association. Wanganui, 13th and 14th November.

Waikato A. and P. Association. Claudelands, 13th and 14th November.

Canterbury A. and P. Association. Christchurch, 14th and 15th November.

Egmont A. and P. Association. Hawera, 20th and 21st November.

Nelson A. and P. Association: Richmond, 22nd and 23rd November.

Stratford A. and P. Association: Stratford, 27th and 28th November.

Southland A. and P. Association: **Royal Show**, Invercargill, 10th, 11th, and 12th December

Helensville A. and P. Association: Helensville, 29th January, 1930.

Dannevirke A. and P. Association. Dannevirke, 11th and 12th February.

Tauranga A. and P. Association. Tauranga, 11th and 12th February.

Masterton A. and P. Association. Solway, 18th and 19th February.

Auckland A. and P. Association. Auckland, 27th and 28th February, and 1st March.

Taranaki Agricultural Society: New Plymouth, 5th and 6th March.

Testing Butter for Water Content.—The testing of export butter for moisture content was continued by the Dairy Division during the past year. A total of 142,934 churnings were tested, the average water content being 15.29 per cent., as against 15.19 for the preceding season. The number of churnings over the legal limit were much fewer than in 1927-28, the percentage of excess having been reduced from 0.873 to 0.059. These results are considered to be very satisfactory, and as reflecting credit on the butter-factory staffs.

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No. 4.

DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF THE 1928-29 SEASON.

Dairy Division.

A STUDY of the past season's herd-testing indicates that during 1928-29 the movement received wider and more systematic support than ever before in the history of dairying in New Zealand. An analysis of returns shows that almost 95 per cent. of the data supplied to the Dairy Division for summarizing purposes was accurate and complete, pointing to methodical and intelligent recording, and in addition there was a very satisfactory increase in the total number of cows tested. Average yield, too, reached a very satisfactory figure, an exceptionally favourable dairying season having played its part in this respect.

Some 259,594 dairy cows were tested in 1928-29, as compared with 224,130 in 1927-28, an increase of 35,464. The animals tested represented 20.1 per cent. of the total of the Dominion's dairy cows in milk, or 18.9 per cent. of all cows—in milk and dry. Although, in retrospect, these percentages are evidence of considerable achievement—the 1919-20 tested cows having been only $4\frac{1}{2}$ per cent. of the Dominion total—it would appear reasonable to hope for steady advancement for some years yet to come. However, one must not lose sight of the fact that as a general rule dairy-farmers do not test every cow every season, so that it is probable that the cows which can rightly be classed as tested cows—that is, cows which have been tested during at least one milking-period—would reach a substantial aggregate. Statistics of this nature are difficult to collect, but it is hoped that a means of putting the work in hand will be found before long.

The present survey follows the lines established by previous reviews, and readers who are interested will be able to make some useful comparisons by referring to the records published in *Journal* issues of earlier years. For the benefit of those who are not conversant with details of nomenclature as applied to herd-testing we may repeat the explanation that in New Zealand this work is carried out under several variants of our original method, and that three systems are now recognized—namely, "Association" (sometimes called "Individual"), "Group," and "Dairy Company." Under the Association system the members themselves do the weighing and sampling of the milk of their cows

Table 1.—Number of Cows tested Twice or more classified according to Season and System of Testing.

System.	1924-25.			1925-26.			1926-27.			1927-28.			1928-29.		
	Organi- zations.	Cows.	Average Cows per Organi- zation.	Organi- zations.	Cows.	Average Cows per Organi- zation.	Organi- zations.	Cows.	Average Cows per Organi- zation.	Organi- zations.	Cows.	Average Cows per Organi- zation.	Organi- zations.	Cows.	Average Cows per Organi- zation.
Association	117	87,605	750	124	59,345	479	116	56,823	489	115	56,099	493	99	45,586	460
Group ..	91	100,055	1,100	86	105,227	1,224	96	109,827	1,144	127	104,610	1,296	158	212,480	1,344
Dairy Com- pany	51	9,100	178	38	5,204	137	28	3,500	125	18	2,821	157	8	1,528	191
All ..	259	196,850	760	248	169,776	685	240	170,150	709	260	224,130	862	265	259,594	979

Year

1922-23

84,825 Cows

1923-24

151,214

1924-25

196,850

1925-26

169,776

1926-27

170,150

1927-28

224,130

1928-29

259,594

Reference : Group Association Dairy Company

GRAPHICAL REPRESENTATION OF EXTENT AND SYSTEMS OF HERD-TESTING IN NEW ZEALAND FOR LAST SEVEN SEASONS.

for two days (in a few cases one day) in every thirty days, while in the case of the Group system weighing and sampling of the milk for each cow on test is done by a testing officer for one day every month. In both cases samples are tested by testing officers, returns figured, and sheets containing results returned to the members. Testing under the Dairy Company system resembles the Association method, except that the testing of the samples is carried out by the dairy factory to which the members are suppliers, and the figuring of returns is left to the herd-owners themselves.

In Table 1 are given details of classification under these three systems for the past five years. The table clearly indicates that both the Association and the Dairy Company system are steadily losing ground, while the Group system is rapidly lengthening its list of supporters. The accompanying graph goes back to 1922-23, the first year of group testing in New Zealand, and affords an interesting representation of the progress of that system and of its tendency to take the place of the original Association system. Not only are there more groups and more cows, but more cows per group than ever before.

Table 2 supplies an indication of the number of cows tested in the various land districts, and, similarly to Table 1, covers a period of five seasons. It is pleasing to note that every land district except one—Otago—has experienced an increase. This statement does not include Westland, from which no systematic testing of dairy herds was reported. The latest available statistics show that Westland has some 11,000 dairy cows in milk, and that it has twelve dairy factories with 608 suppliers. It would therefore seem that there is room for several fairly strong herd-testing organizations on the West Coast. It will be noticed that there has been a satisfactory revival of interest in both Nelson and Marlborough, while the South Island as a whole has shown a greater increase than has hitherto been experienced.

Table 2.—Number of Cows tested Twice or more, classified according to Season and Land District, &c.

Land District, &c.	1921-25	1925-26.	1926-27.	1927-28.	1928-29.
North Auckland ..	31,049	24,951	24,616	41,067	48,713
Auckland ..	93,912	77,651	82,338	101,796	106,823
Gisborne ..	4,022	3,891	2,026	5,750	9,579
Hawke's Bay ..	5,468	4,902	2,987	4,638	8,243
Taranaki ..	16,840	16,485	14,606	23,581	30,298
Wellington ..	37,415	29,653	29,517	32,207	36,547
North Island ..	188,706	157,533	156,780	200,105	240,203
Nelson ..	574	880	620	656	1,241
Marlborough ..	147	441	258	434	2,176
Westland ..	..	..	74	..	..
Canterbury ..	2,171	1,799	4,292	3,280	3,524
Otago ..	1,859	903	950	769	581
Southland ..	3,393	8,220	7,176	9,886	11,869
South Island ..	8,144	12,243	13,370	15,025	19,391
Dominion ..	196,850	169,776	170,150	224,130	259,594

Table 3 provides particulars of the number and size of the various organizations operating last season, the summary being based on all cows in milk at least 100 days. Taken as a whole, and judged in the light of the information already given, this table has no unusual features except perhaps the substantial increase in the average number of cows per organization. Even this would not be altogether unexpected when one stops to consider the retrogression of association testing and the increased number of group organizations with their larger membership. In this table the term "organization" denotes any herd-testing body, whether Group or Association. Moreover, the term "organization" also applies to each individual unit. For instance, the New Zealand Co-operative Herd-testing Association (Inc.) is not included as one unit, but as sixty-seven, which was the number of individual groups under its control last season.

Table 3 - Number of Cows, Herds, and Organizations represented in Effective Seasons' Summaries received (Based All Cows in Milk 100 Days or over)*

	1926-27.	1927-28.	1928-29.
Number of organizations	211	242	257
Number of herds	4,678	5,927	6,663
Number of cows	155,028	206,323	245,811
Average number of herds per organization	22	24	25
Average number of cows per herd ..	33	35	36
Average number of cows per organization..	734	853	956

* Including both Group and Association systems, and on basis of sections or units.

In Table 4 the groups and associations are classified according to herds and cows, and the figures bear out our remarks relating to Table 3. There is an increase in herds per group, and a considerable increase in cows per group. The average number of cows per herd appears to be fluctuating around a point. This, however, is a matter independent of testing, and involves the question of size of farm, &c., as under group-testing rules all normal cows must be entered. The Association half of the table indicates a slight decrease under each heading. In explanation of this falling-off, however, it should be stated that frequently only cows previously untested are placed under

Table 4. - Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System.	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association ..	1925-26	19	407	22
	1926-27	18	408	22
	1927-28	21	414	20
	1928-29	20	401	19
Group ..	1925-26	27	1,205	44
	1926-27	26	1,127	43
	1927-28	28	1,250	45
	1928-29	29	1,304	44

Association test, and, moreover, the Association system is now principally operated among small farmers in scattered districts where the Group method would not be practicable. Group testing is economical in cost to the farmer only in more or less intensive dairying districts.

The effective summaries received for the 1928-29 season represent 94.6 per cent. of the total number of cows tested twice or more for all groups and associations operating in the Dominion. This position is very gratifying, and we should like to place on record once more our appreciation of the courteous and valuable service which the officers in charge of the various herd-testing organizations have rendered in this connection. For purposes of this review production summaries are based on all cows in milk 100 days or more, which is the accepted standard for the compilation of ordinary herd-testing returns. There were 245,811 cows in our effective summaries for the past season, or 39,448 more than for 1927-28.

The average-yield figure, which last year was down to 224.68 lb. of butterfat, has risen for 1928-29 to a fraction more than the 1926-27 mark. The average butterfat production for the season under review works out at 240.50 lb., which, taking into account the marked increase in total cows represented, is a very satisfactory attainment. A grand summary of production results for the past season is supplied by Table 5.

Table 5 —Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons

	1927-28.		1928-29	
	Days in Milk.	Butterfat-production.	Days in Milk.	Butterfat-production.
		lb		lb
Average for all cows (206,323 in 1927-28 and 245,811 in 1928-29)	230	224.68	242	240.59
Highest Association or Group average ..	258	377.70	273	358.50
Lowest Association or Group average ..	185	116.08	140	131.76
Highest herd average ..	272	484.88	322	475.70
Lowest herd average ..	112	68.03	115	50.54
Highest cow ..	203	858.20	305	888.00
Lowest cow ..	130	7.74	105	8.00
Average daily production of butterfat for all cows	..	0.98	..	0.99

A matter which may be introduced before continuing the subject of average production—and a very interesting and important one—concerns the proportion between the total cows used for dairying purposes and the number actually in milk. Statistics relating to this subject are supplied by Table 6. It will be noticed that in five years the dairy-cow population has increased by 47,631. But there were 95,637 more cows milked in 1928-29 than in 1924-25, while, despite the increase in total cows, the number of dry cows has decreased by 46,000 in the five years. This surely represents a more satisfactory economic position, as there is a marked tendency in the direction of decreasing the proportion of non-producing cows.

Table 6. - Cows in Milk and Dry.

Season.			Total Cows.	Cows in Milk.	Dry Cows.
1924-25	..	..	1,323,432	1,195,567	127,865
1925-26	..	..	1,303,856	1,181,441	122,415
1926-27	..	..	1,303,225	1,181,545	121,680
1927-28	..	..	1,352,398	1,242,729	109,669
1928-29	..	..	1,371,063	1,291,204	79,859

Table 7 supplies a classification of production according to system of operation, the two principal systems—namely, Group and Association—being the classifications adopted. In view of the marked rise in average production for all cows from last season, it would naturally be expected that both systems would show an increase. In actual fact the Group average rose by some 13.23 lb. butterfat, while the Association average increased by 22.26 lb. Considering that there were 43,870 more Group cows tested last year than the year before, a meritorious standard has been attained.

Table 7—Average Production of all Effective Results for Past Three Seasons classified according to System (Basis: All Cows in Milk 100 Days or over)

Season.	System.	Number of Associations or Groups.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat.
1926-27	Association	115	2,140	46,878	220	lb. 232.64
	Group ..	96	2,538	108,150	241	243.88
1927-28	Association	115	2,380	47,589	204	212.07
	Group ..	127	3,538	158,734	237	228.46
1928-29	Association	99	2,000	39,722	222	234.33
	Group ..	158	4,663	206,089	246	241.69

In keeping with the procedure followed in previous summarizing we have again taken out a production classification on the basis of all cows which have been tested for seven periods—that is, 210 days or more. This summary, however, applies only to those associations conducted by the Dairy Division's Testing Officers and the returns figured in the Division's head office. It would be very interesting and useful if similar figures could be obtained for all organizations in the Dominion, but on account of the labour involved privately-controlled organizations have not been asked to supply the necessary particulars. A summary founded on a seven-months period affords results more in conformity with the length of a dairying season, and provides more exact evidence of what our average normal cow is capable of producing. The 100-day summary, on the other hand, would include performances of a number of cows of such poor quality that they do not continue in milk for 210 days. The 100-day summary has the disadvantage, however, of including certain records which should perhaps be omitted—the records, among others, of cows which have died, fallen sick, or

been sold or culled, and thus ceased being tested at a date preceding that on which, under normal conditions, their test would have been completed.

Table 8 enables a comparison with previous years between results of yield for cows in milk 100 days and more and cows in milk 210 days and more for Association testing carried out by officers of the Dairy Division. A point which is noticeable is that the 100-day average has risen by 17·86 lb. butterfat, while the 210-day average has only gone up by 9·35 lb. The explanation largely lies in the fact that the 100-day average lactation is no less than thirteen days longer than last year, whereas the 210-day average milking-period has gone up only four days. The slow but certain increase in average lactation is not the least desirable feature of the herd-testing development. For many years the average dairy cow did not milk more than seven months. The eight-months mark has now been reached. If the dairy industry could so develop its cows as to produce economically for ten months, even then two months' rest would be left for the producers, and the annual output of dairy-produce greatly added to.

Table 8.- Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more

Year.	100 Days or more.		210 Days or more.	
	Average Days.	Average Butterfat.	Average Days.	Average Butterfat.
		lb.		lb.
1924-25	223	231·51	258	260·29
1925-26	218	221·19	257	259·20
1926-27	236	247·35	262	273·36
1927-28	229	246·01	264	282·54
1928-29	242	264·77	268	291·89

In Table 9 average butterfat-production has been classified according to land districts. Compared with the preceding season there has been an increase in average yield in every land district except two. Districts which, all things considered, stand out are Nelson and Marlborough. The past season's results should be an encouragement to further effort, and present indications point to the fact that a substantial increase in herd-testing in these two districts may be expected for the 1929-30 season.

Table 10 is interesting from the point of view of illustrating the difference in distribution of records for the Group and Association systems. In the upper half of each of the two seasons' tabulations the numbers of records are given, while in the lower half these have been converted to percentages. A perusal of this table over a period of years reveals a gradual thinning-out of the lower subdivisions and a trend toward the average cow-yield. It is also apparent that increased average production is being brought about not so much by the fact that the good cows are better than in the past, but because through the elimination of the poorer producers the dairy cow is becoming, as

TABLE 9.—Average Lactation, according to Lana Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained. (Basis : 100 Days or over).

Land District, &c.	1925-26.			1926-27.			1927-28.			1928-29.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.
North Auckland ..	20,925	224	lb 210.94	21,471	224	lb. 232.46	36,395	211	191.66	45,735	234	lb. 222.87
Auckland ..	73,101	236	226.08	78,625	240	244.82	95,799	235	225.04	102,239	247	238.27
Gisborne ..	3,368	212	191.03	2,405	217	218.08	5,244	231	234.39	9,045	233	230.45
Hawke's Bay ..	4,294	224	189.32	2,285	230	208.95	4,107	230	233.72	7,705	243	249.61
Taranaki ..	12,846	235	242.42	12,857	241	239.67	22,180	238	247.01	28,515	249	259.76
Wellington ..	22,043	223	212.64	25,400	258	256.53	29,300	233	244.89	34,524	243	257.93
North Island ..	136,577	231	221.11	143,043	240	252.29	193,025	230	224.72	227,763	243	240.92
Nelson ..	609	192	207.16	261	233	239.27	341	154	162.44	936	203	237.00
Marlborough ..	..	..	..	..	..	..	..	..	..	1,956	217	244.84
Westland ..	..	..	..	..	..	..	..	..	..	..	..	..
Canterbury ..	391	195	217.21	3,917	207	219.03	2,847	226	222.57	3,081	218	237.67
Otago ..	804	218	223.60	820	199	247.02	720	239	273.42	552	219	253.99
Southland ..	8,017	217	211.14	6,987	217	215.36	9,390	220	222.94	11,523	225	231.89
South Island ..	9,821	214	212.15	11,985	213	219.06	13,298	221	224.04	18,048	222	235.22
Dominion ..	146,398	230	220.51	155,028	238	240.48	206,323	230	224.68	245,811	242	240.50

Table 10.—*Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Seasons 1927-28 and 1928-29 (Basis: 100 Days or over.)*

System.	Class Limits (in Pounds of Butterfat).																		Total Number of Cows classified.
	Under 50.	50-100.	100-150.	150-200.	200-250.	250-300.	300-350.	350-400.	400-450.	450-500.	500-550.	550-600.	600-650.	650-700.	700-750.	750-800.	800-850.	850-900.	
1927-28.																			
Numbers																			
Association Group ..	41	2,386	8,947	11,449	10,398	7,433	4,314	1,743	648	168	40	16	3	2	..	..	..	1,47,589
Both ..	552	5,620	19,194	34,508	39,525	31,326	17,956	7,062	2,163	563	127	35	7	2	3	1	..	158,734	
Percentages																			
Association Group ..	0.09	5.01	18.80	24.06	21.85	15.62	9.07	3.66	1.36	0.35	0.08	0.03	0.01	*	..	..	*	47,589
Both ..	0.35	3.54	12.09	21.80	24.90	19.73	11.31	4.45	1.36	0.35	0.08	0.02	*	*	*	..	..	158,734
1928-29.																			
Numbers																			
Association Group ..	32	1,132	4,780	8,075	9,414	7,830	4,883	2,363	843	265	79	17	6	2	1	..	..	39,722
Both ..	468	5,384	17,993	38,032	51,220	45,775	28,341	12,811	4,440	1,230	299	67	15	2	..	2	..	1206,089	
Percentages																			
Association Group ..	0.08	2.85	12.03	20.33	23.70	10.71	12.29	5.95	2.12	0.67	0.20	0.04	0.02	*	*	..	..	39,722
Both ..	0.23	2.61	8.73	18.45	24.86	22.21	13.75	6.22	2.15	0.60	0.14	0.03	0.01	*	..	*	..	206,089	
Percentages																			
Association Group ..	0.20	2.65	9.26	18.76	24.67	21.81	13.52	6.17	2.15	0.61	0.15	0.03	0.01	*	*	*	..	245,811	

* Data occurring, but relatively insignificant.

it were, more standardized. It is realized that in actual practice culling is often difficult, and that without ready replacement it is not always desirable. What is required is the breeding of a better and more uniform animal to replace what is called the cull cow.

Table 11, which is similar to Table 10, except that it includes productions on the 210-day basis, bears out our remarks concerning the latter table. As pointed out in a previous review, it is clear that the higher yield of cows in the 210-days-or-more class is not so much accounted for by the fact that it contains more higher-yielding animals, but because there are fewer cows in the lower-production subdivisions.

Table 11.—Percentage Distribution of Records and Herd Averages in Organizations controlled by Dairy Division, Season 1928-29.

Basis.	Class Limits (in Pounds of Butterfat).															Total Number classified.	
	Under 50	50- 100	100- 150	150- 200	200- 250	250- 300	300- 350	350- 400	400- 450	450- 500	500- 550	550- 600	600- 650	650- 700	700- 750		
Records.																	Cows.
100 days and over	0.02	1.24	7.34	13.71	22.61	22.87	16.58	9.66	3.95	1.37	0.47	0.09	0.06	..	0.02	5,259	
210 days and over	0.03	0.03	0.95	7.57	22.41	27.28	21.21	12.66	5.19	1.80	0.63	0.12	0.08	.	0.63	3,988	
Herd Averages.																	Herds.
100 days and over	..	0.34	3.79	12.07	20.34	28.62	22.76	8.62	2.76	0.69	..	..	.	.	.	290
210 days and over	..	.	3.56	17.39	32.01	29.25	12.65	3.95	1.18	..	..	..	.	..	.	253

Summing up, it may safely be said that the New Zealand dairy industry is justified in viewing the general position with satisfaction. More cows are being milked each year, the dairy-cow population is increasing (though perhaps not as rapidly as one might wish), and average production per cow is slowly but certainly on the upward trend. From the broader point of view the market values and general conditions relating to the commerce in dairy-produce presage a hopeful future, provided our quality is equal to the demands of the consumer.

GOVERNMENT SUBSIDY AND HERD-TESTING CENTRAL EXECUTIVE.

Some of the increased support accorded the herd-testing movement by the industry must be credited to the Government's assistance through grants to testing dairy-herd owners. The first subsidy was granted in July, 1927, for the 1927-28 dairying season, the amount being £8,000, subsequently increased to a maximum of £9,500, to enable a subsidy of 1s. per cow to be paid on animals eligible for subsidy on testing carried out under the Group system and 6d. per cow for the Association system. The second subsidy was increased to £10,500, and has been applied to the 1928-29 testing. A similar amount has been granted for distribution in due course on account of the current season (1929-30).

Shortly after the first grant was made a small Board was set up to advise concerning its distribution. This body, named the Herd-testing Subsidy Allocation Board, comprised five members—namely, Messrs. Dynes Fulton, Hamilton (Chairman); A. Morton,

Egmont Village (representing the National Dairy Association); W. A. Iorns, Martinborough (representing the New Zealand Dairy-produce Board); G. R. Herron, Pukerau (representing the South Island Dairy Association); and W. M. Singleton, Director of the Dairy Division. The Board operated for two seasons, during which time it rendered valuable service to the herd-testing movement.

In July, 1929, the place of the Allocation Board was taken by the New Zealand Herd-testing Central Executive, a larger and more representative body set up to advise concerning the general policy of herd-testing in the Dominion, and of herd-testing matters as a whole. This executive is comprised of Messrs. Dynes Fulton, P. W. Hill, G. H. Bell, and G. R. Herron (Dominion Group Herd-testing Federation), W. A. Iorns (Dairy-produce Board), Professor W. Riddet (Dairy Research Institute), Dr. C. J. Reakes (Director-General of Agriculture), and the Director of the Dairy Division. Mr. Dynes Fulton is Chairman of the executive; Mr. H. G. Philpott, of the Dairy Division, acts as secretary.

In addition to the grant of £10,500 to testing dairy-herd owners, the Government has made a grant to the Dominion Group Herd-testing Federation to cover the cost of a supervisor. On the recommendation of the Central Executive, Mr. C. M. Hume, who has acted as manager of the New Zealand Co-operative Herd-testing Association since its inception, has been appointed Federation Supervisor of Herd-testing. It is expected that the services of the Herd-testing Central Executive, together with those of the Federation Supervisor, will do much toward improving our herd-testing systems, curtailing costs, and standardizing practice. It is also hoped that the united and systematic endeavour now being put into operation will tend to make every herd-testing organization efficient and self-supporting, so that the State may in due time be able to withdraw its financial assistance.

PARASITIC GASTRITIS IN LAMBS.

THE Director of the Live-stock Division refers to this trouble in his annual report for 1928-29, as follows -

A considerable mortality from parasitic gastritis occurred among lambs, more particularly in the Wellington Province, some flocks suffering rather heavily. Owing to the damp season experienced this was to be expected, and under such circumstances owners should see that their lambs are well cared for, particularly at weaning-time. At this time, if lambs are allowed to fend for themselves without suitable feed being provided, a check in their growth is unavoidable, thus weakening the resisting-power of the young animals, with the result that they become a prey to parasites. Once such a condition becomes established it is almost impossible to avoid heavy mortality, as only those with strong constitutions will be able to survive. In such cases the lambs eat but sparingly, and cannot be induced to take artificial food. At this stage medicinal treatment frequently does more harm than good, for even if the parasites are destroyed the animals have not sufficient recuperative powers to enable them to recover. In those flocks where suitable feeding-conditions are available to enable them to get over the weaning and carry them into the winter without going back in condition, the loss is infinitesimal compared with that in those flocks for which little or no provision is made. Many sheep-farmers now realize that it pays to give their lambs proper attention, and it is to be hoped that the remainder will follow their example. When this condition is general the heavy death-rate among hoggets during the winter months will be reduced considerably.

INTENSIVE GRASS-FARMING.

DAIRY-FARM EXPERIMENT AT MANAWARU, SEASON 1928-29.

J. W. WOODCOCK, N D A., Instructor in Agriculture, Hamilton.

THE results of recent research work indicate the possibility of greatly increasing the per-acre production of butterfat from the dairying grasslands of New Zealand by the more intensive use of fertilizers and the adoption of improved methods of grass utilization. Briefly, the new system consists in the close subdivision of grass-land, regulated stocking, and heavy and complete manuring. Grass is treated as a crop, the pasture being allowed to reach a height of 3 in. to 5 in., quickly grazed down, and then spelled till the next crop of young grass is ready.

An experiment to test the application of the new methods of grassland management to New Zealand conditions was commenced on Mr. John Ward's farm, at Manawaru, near Te Aroha, in 1927-28, and was continued during the 1928-29 season. An article by G. W. Wild, describing the first season's work, appeared in the December, 1928, issue of this *Journal*. The outstanding feature of that season was the large increase in the per-acre production of butterfat, which rose from 161 lb. in 1926-27 to 203½ lb. in 1927-28.

In the 1928-29 season Mr. Ward's farm, which is 50 acres in area, was subdivided into thirteen fields, all of which were in grass. It will be seen from the sketch-plan (Fig. 3, page 230) that all the fields radiate from a central race, which is the most convenient arrangement for the satisfactory working of a rotational grazing scheme. Water is supplied to each field.

MANURING AND MANAGEMENT OF THE FARM PASTURES.

The pastures were top-dressed with 4 cwt. per acre of superphosphate during June, 1928, and 2½ cwt. during the following August, and those not closed for hay received a further 1½ cwt. during December. All the fields were again top-dressed with super at the rate of 2 cwt. per acre in March, 1929.

Six of the fields, together comprising half the grazing-area, were treated with sulphate of ammonia at various times during the season, 80 lb. per acre being applied in July, 1928, 1 cwt. in October, 100 lb. in December, and 1 cwt. in March, 1929. It is not intended to discuss the effects of the nitrogenous dressings until another season's trial is completed. The floods which occurred in July and September, 1928, almost nullified the effects of the July application of nitrogen, which has been shown elsewhere to be the most remunerative of the nitrogenous dressings.

Carbonate of lime was applied to all fields during May, 1929, at the rate of 10 cwt. per acre, with the exception of a ½-chain strip at 1 ton per acre and an equal strip without lime, to enable observation to be made of the effect of liming.



FIG. 1. VIEW ON MR. WARD'S FARM, SHOWING CENTRAL RACE, WITH 3-ACRE FIELDS ON EACH SIDE.

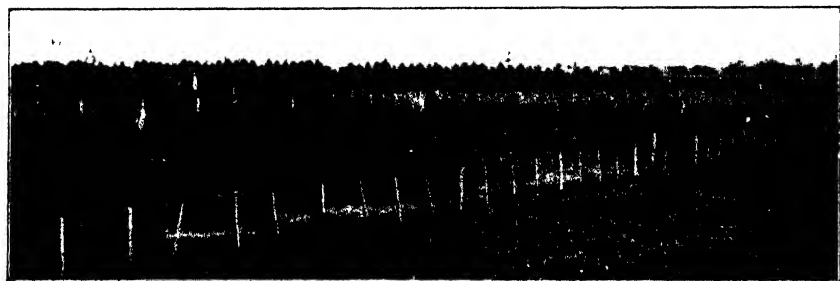


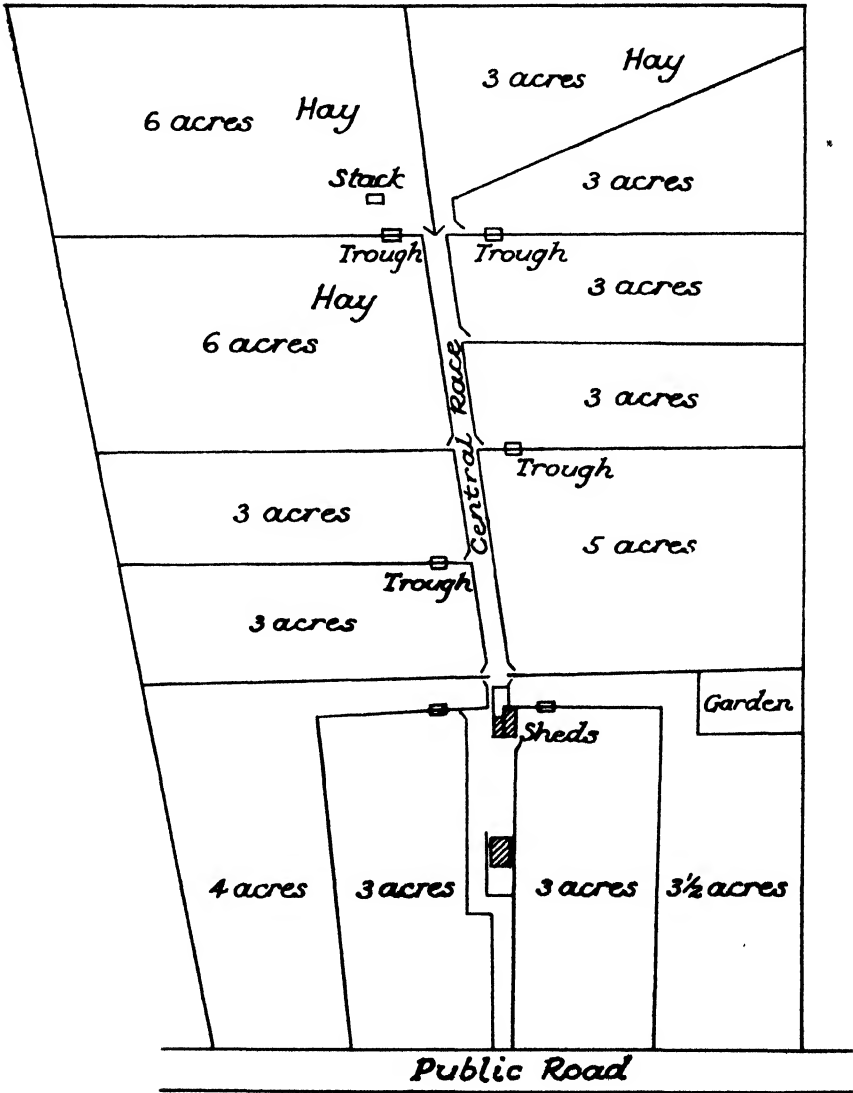
FIG. 2. PORTION OF THE HERD GRAZING A FIELD IN AUGUST.

A strip 2 chains in width across each field, and at right angles to the other dressings, was dressed with 30 per cent. potash salts, at the rate of 2 cwt. per acre, in March, 1929.

The system of grazing was a modification of that adopted in the previous season. Instead of being grazed for ten-day periods on the ammonia and phosphate portions of the farm in turn, the fields were grazed when they were ready, irrespective of their place in the grazing rotation. It will be found on all farms where such a system of rotational grazing is commenced that some fields, by reason either of their superior sward, natural fertility, or some other cause, recover more quickly from grazing than others, and the farmer must be guided by his own judgment rather than follow a set rotation when such conditions occur. In the experiment under review it was intended to graze down each field, when the grass had attained a height of 3 in. to 5 in., with the milking-herd, followed by the dry stock to clean up the roughage. Any tendency of the grass to go to seed was checked by the use of the mower when necessary. The pastures were then harrowed and spelled until another flush of grass was ready.

It was decided to close 6 acres for hay and 6 acres for ensilage, together with any other fields which might not be needed for grazing purposes. Unfortunately, the whole farm was under water

for three days in July through the blocking of a culvert, and another flood occurred in September, so that grass-growth received a very severe check. In these circumstances much less grass was shut up for hay and ensilage than was at first anticipated, and with



Scale: 5 chains to 1 inch

FIG. 3. SKETCH-PLAN OF MR. WARD'S FARM, SHOWING SUBDIVISIONS, POSITION OF WATER-TROUGHS, BUILDINGS, ETC.

further unfavourable conditions experienced in November and early December the growth on the fields closed for ensilage was hardly sufficient to warrant the making of a stack. All the surplus grass was therefore converted into hay.

MANAGEMENT OF THE DAIRY HERD.

Throughout the early part of the season until the aftermath of the hay-fields was available there were nine fields of about 3 acres each and one 5-acre field available for grazing. With the herd consisting of thirty-seven cows the fields were grazed at the rate of twelve cows per acre, and this was considered sufficient to get two grazing-days of twenty-four hours each. The nine head of dry stock following the milking-herd were also kept on the fields for two days, and the roughage was cleaned up fairly well by this means.

In early December the effects of the flood, followed by close grazing in September, became apparent, and, although the production for the season was only a little behind that of the previous season, the production per cow was much lower, and there was a risk of production falling away badly in the event of a drought. It was therefore decided to reduce the stocking to some extent by sending the dry stock away from the farm, and to divide the herd so that seven or eight of the poorer cows should act as followers to the main herd. This scheme was tried, but after a while was abandoned on account of the inconvenience caused during milking, and the herd was afterwards worked in one unit. The fact that the fields had a better chance to recover after grazing and that production was immediately increased justified the policy of sending away the dry stock. It was then necessary to resort to the mower to keep down excessive rank growth and seed-heads.

SUPPLEMENTARY FEED.

During February and March very dry conditions prevailed, and concentrates consisting of one part linseed-cake, one part bran, and two parts crushed oats were fed to the cows at the rate of 2 lb. per head per day from 1st February, increased to 6 lb. per day from 11th March until the end of that month.

If silage had been available it would have been fed to the stock during this period. Such periods of drought commonly occur during late summer in Auckland Province, and where a supply of silage has been conserved it will go a long way to meet the deficiencies at this time of the year. It is quite possible, however, that when intensive grass-farming becomes general some concentrate may become necessary if the sharp decline in yield during such periods of scarcity is to be stemmed, and so that the flush of grass which appears when rain does come may be consumed by cows which are still producing fairly highly.

BUTTERFAT-PRODUCTION.

From the figures of production over the last three seasons (Table 1) and the graph (Fig. 4) it will be seen that in spite of very unfavourable

conditions in the early part of the 1928-29 season a very satisfactory increase in carrying-capacity and butterfat-production was accomplished.

Table 1.—*Butterfat-production on Mr. Ward's Farm.*

Season.	Number of Fields.	Butterfat to the End of December.	Butterfat to the End of May.	Butterfat per Acre.	Number of Cows.	Butterfat per Cow.	Fertilizers.	
							Super-phosphate.	Sulphate of Ammonia.
		lb.	lb.	lb.		lb.	Tons.	Tons.
1926-27	8	4,111	8,043	161	27	298	7½	..
1927-28	10	5,812	10,173	203½	32	318	14	2
1928-29	13	5,385	10,624	212½	37	287	22½	4½.

It will be noted that there was an increase of 2,130 lb. of butterfat in the 1927-28 season over the production of 1926-27, and production was further increased last season by 451 lb. The latter increase was obtained in spite of the fact that till the end of December production was over 400 lb. behind that of the 1927-28 season, a state of affairs which can be attributed entirely to the floods, for it will be seen from the graph that production on this farm is usually at its highest about October.

The records of rainfall at Te Aroha show that while the 1926-27 season, with a rainfall well distributed throughout the year, was a good one for dairying, the following season, with its summer drought, was largely unfavourable. A period of very dry weather also occurred during January, February, and early March of the 1928-29 season. The increased production during the two seasons in which the experiment has been carried on was therefore obtained under comparatively adverse climatic conditions. Table 2 gives the monthly rainfall for the three seasons.

Table 2.—*Rainfall at Te Aroha for Seasons 1926-27 to 1928-29.*

Month.					1926-27.	1927-28.	1928-29.
June	..	..	..	..	2.35	4.08	4.23
July	..	..	..	..	8.37	10.44	17.28
August	..	..	..	..	6.52	6.91	4.79
September	..	..	..	..	2.18	4.83	6.53
October	..	..	..	..	7.65	1.57	6.76
November	..	..	..	..	6.87	3.69	2.68
December	..	..	..	..	4.38	1.66	5.00
January	..	..	..	..	2.00	0.15	2.63
February	..	..	..	..	3.89	2.17	0.36
March	..	..	..	..	5.19	9.28	4.11
April	..	..	..	..	2.44	6.84	8.15
May	..	..	..	..	5.93	11.91	4.84
Total for year					57.77	63.53	67.36

The Fig. 5 graph shows the production from Ward's farm and four other farms in the same locality worked out on a 50-acre basis for ten-day periods. A graph of actual tri-monthly production generally shows high peaks on the 31st of certain months, due to

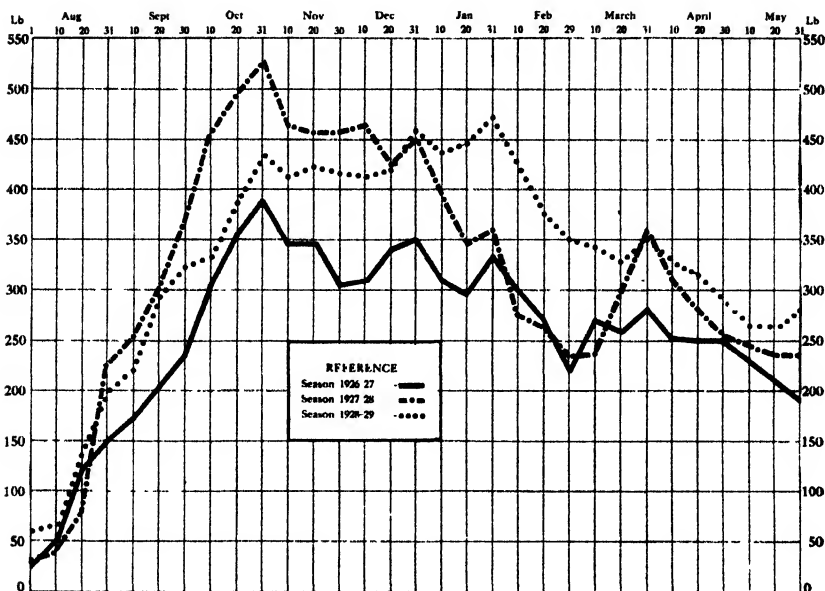


FIG. 4. GRAPH SHOWING BUTTERFAT-PRODUCTION OF MR. WARD'S FARM FOR LAST THREE SEASONS

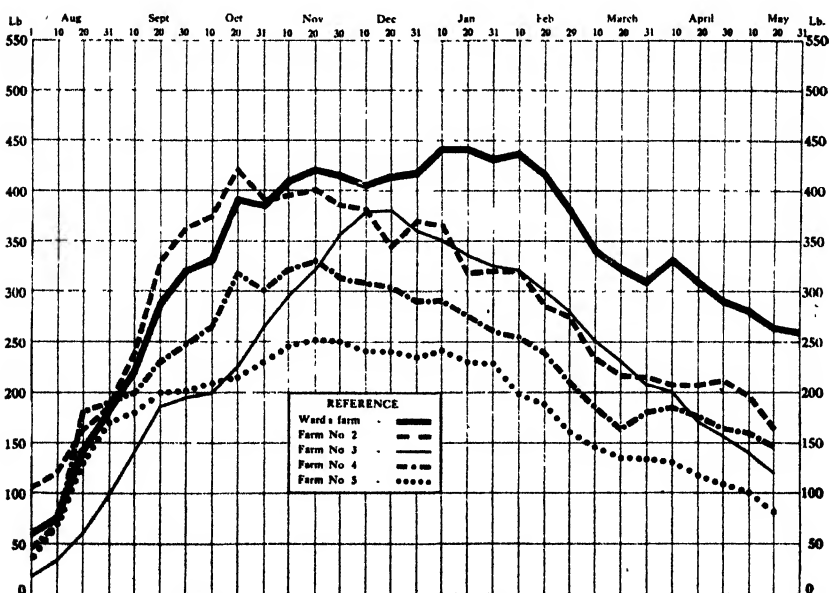


FIG. 5. GRAPH SHOWING BUTTERFAT-PRODUCTION PER 50 ACRES FOR TEN-DAY PERIODS DURING 1928-29 SEASON FOR MR. WARD'S FARM AND FOUR OTHER FARMS IN SAME LOCALITY.

the fact that there are eleven days in the last period, but in Fig. 5 the extra day has been ignored except in February, when production on 31st January and 1st March is taken into account, so that the peaks shown in Fig. 4 on 31st October, December, January, and March do not appear in the second graph.

It will be seen that on the other farms shown in the graph the highest production was obtained well before the end of December, but that on Ward's farm the peak period comes during January, and production falls gradually until late February, when the drought experienced at that time began to make itself felt on production.

There is always the tendency for peaks of production to be less acute under a system of rotational grazing, when pastures are kept under control in late spring and early summer. It is considered that a late spring application of superphosphate, such as was made on Ward's farm in December, is most valuable in stimulating clover-growth during the dry weather of February and March.

DIFFICULTIES IN ROTATIONAL GRAZING.

On a farm where all the fields are intensively rotationally grazed it is not always possible to wait until pastures reach a certain stage before feeding off unless ensilage or some other supplementary feed is available. When all the fields have been grazed in rotation fresh feed must be supplied to the stock irrespective of the amount of growth on the field next ready for grazing. Consequently it should be realized that before embarking on a system of intensive rotational grazing a good reserve of supplementary feed must be available.

Table 3 shows the various grazing-cycles during the 1928-29 season on Ward's farm, and in column 2 is given the number of days taken by the cows and dry stock to graze all the pastures on the farm. Since most of the fields are 3 acres in extent the grazing-area available for the cows during each cycle has been

Table 3.—Grazing-cycles on Rotationally grazed Pastures on Ward's Farm.

Period of Grazing.	Number of Days.	Number of Milking-cows.	Number of Dry Stock.	Number of 3-acre Fields Equivalent.	Average Time Cows allowed to graze 3-acre Field.
					Days.
(1) 1/9/28 to 17/9/28 ..	16	33	13	16	1
(2) 17/9/28 to 3/10/28 ..	16	35	10	16	1
(3) 3/10/28 to 22/10/28 ..	19	36	10	14	1½
(4) 22/10/28 to 10/11/28 ..	19	37	9	11*	1½
(5) 10/11/28 to 1/12/28 ..	21	37	9	11*	2
(6) 1/12/28 to 24/12/28 ..	23	37	9	11*	2
(7) 24/12/28 to 14/1/29 ..	21	37	3	11*	2½
(8) 14/1/29 to 1/2/29 ..	18	37	..	11*	1½
(9) 1/2/29 to 26/2/29 ..	25	37	..	16	1½
(10) 26/2/29 to 13/3/29 ..	15	37	..	16	1
(11) 13/3/29 to 30/3/29 ..	17	36	..	16	1
(12) 30/3/29 to 21/4/29 ..	22	36	..	16	1½
(13) 21/4/29 to 4/5/29 ..	13	36	..	16	1
(14) 4/5/29 to 22/5/29 ..	18	36	..	16	1
(15) 22/5/29 to 1/6/29 ..	10	36	3	16	½

*15 acres closed for hay.

expressed in column 5 as equivalent to a certain number of 3-acre fields. In the last column the approximate length of time taken for the herd to graze 3 acres at various times throughout the season has been worked out.

It will be seen that during late spring and early summer, when grass was at its optimum stage of growth for feeding, thirty-seven milking-cows and nine head of dry stock took two days to graze a 3-acre field. In early spring and late summer, however, conditions were so adverse that the recovery period was too prolonged to enable that optimum stage of growth to be reached, and the grass was eaten down in one to one day and a half. It would appear that 3 acres was a convenient size for this herd, since grass was consumed in two days during the flush period and in one day and a half during the greater part of the season.

During those times when the recovery period is naturally prolonged it is necessary to either shorten that period by the use of stimulating fertilizers, or to supplement the pastures by feeding out silage. It is during the early spring that one looks to nitrogenous fertilizers to give that stimulation of growth so that the recovery period may be considerably shortened. In dry periods the effects of such fertilizers in this direction have not been so pronounced, and it is to silage that one must turn to supplement the pastures, since growth of grass cannot easily be stimulated in the absence of moisture.

SUMMARIZED POINTS.

(1) The storing-up of hay and ensilage should always precede the adoption of more intensive methods of grass-farming and an increase in the numbers of the dairy herd.

(2) The size of fields on rotationally grazed farms is determined by the rate of stocking, and it would appear that this should be at the rate of twelve to fifteen cows per acre, more or less, according to the fertility of the land.

(3) A good even grass-growth 3 in. to 4 in. high will give two-grazing-days of twenty-four hours each for twelve to fifteen cows per acre.

(4) When the grass-recovery period is prolonged through adverse weather conditions the pasture should be supplemented by the feeding of ensilage.

(5) It is possible that the feeding of concentrates during periods of drought may be advantageous on intensively grazed farms.

GENERAL.

During the current season (1929-30) further experimental work will be carried out on Mr. Ward's farm, which is now subdivided into sixteen fields of 3 acres each. The work during the past two seasons has been considerably hampered by weather and flood conditions, but in spite of these setbacks much information on the technique of rotational grazing has been gained.

Mr. Ward's valuable and keen co-operation throughout the year and Mr. G. Graham's courtesy in supplying figures of milk-tests from the Manawaru Cheese-factory are acknowledged by the writer.

DISEASES OF DAIRY COWS.

OBSERVATIONS IN EUROPEAN CENTRES.

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THE object of a recent visit to the dairying countries of Europe on behalf of the New Zealand Department of Agriculture was to study and report on the control and eradication of animal-diseases. The writer, at the outset, takes the opportunity of expressing his indebtedness to the many veterinary colleagues on the Continent and in Britain whose kindness and assistance, and in many cases whose personal introductions, opened the door and paved the way for a very useful interchange of ideas on important agricultural and veterinary problems. The writer at the same time acknowledges with thanks the helpful co-operation of the High Commissioner for New Zealand in London and members of his staff in connection with the tour.

It is the aim of this series of articles on the diseases of dairy cows to record faithfully the present position regarding control in the countries visited.

I. BOVINE MASTITIS.

Mastitis (mammitis), or inflammation of the udder of the dairy cow, creates a problem of world-wide significance, since it occurs under all conditions of herd-management, in the field as well as in the cowshed, yet it is surprising how little is known regarding the condition, or perhaps, what is of more importance, how little can be done in prevention and cure.

From the farmer's point of view the disease is important for many reasons. The milk from the quarter may be unsaleable; the cow's life may be endangered; and the produce from the whole herd may be so contaminated that its keeping-qualities are impaired, or, if made into butter and cheese, the latter will be of inferior quality. Contaminated milk will present also its public-health aspect—namely, the transmission and spread of milk-borne disease. Again, in dairying countries such as New Zealand, where the manufactured produce is mainly exported, the manufacture of such produce from milk of doubtful purity will result in lack of uniformity and consequently a lowering of the saleable standard of the national product generally. The question of mammitis-control, therefore, is intimately associated with the question of a pure milk-supply, and accordingly a problem of great economic importance both to the farmer and to the Government in all dairying countries.

Clinically, the occurrence of mastitis can best be interpreted as acute, subacute, and chronic, according to the intensity of the morbid changes in the affected udder, and to the degree of systemic disturbance manifested by the animal. The method of infection, the extent and localization of the pathological changes, and also the type of infecting organisms, may present other but less useful classifications. A combination of the latter with the clinical interpretation would appear to

meet the situation very well, and hence one speaks of an acute streptococcal mammitis. Formerly a contagious and non-contagious mammitis was described, but in the light of modern bacteriological research it must be understood that the disease in all its forms is essentially contagious, whatever the mode of entry of the invading organisms.

The entrance of the organisms causing mammitis in all its forms must be accepted as taking place in one of three ways—(1) by way of the teat-canal, (2) through the udder integument, (3) centrifugally by way of the blood-stream from localizations of pre-existing disease—and it has been time and again definitely established that the most important and most common mode of entry is by way of the teat-canal. The virulence or pathogenicity of the invading organisms and the susceptibility of the animal are the two essential factors governing the onset of mammitis, the clinical manifestations, and finally the subsequent condition of the affected udder.

It is said that once a quarter has been infected the invading bacteria may never leave the gland. If this be true in all cases then it is a very important finding, which must never be lost sight of in any system of prevention or cure. Such an animal constitutes the chronic or "carrier" case, and while harbouring the organism presumably responsible for a previous acute manifestation in the herd may secrete apparently normal milk for months even, and may finally exhibit the clinical exacerbations of an acute or subacute infection. It is interesting to note that mastitis in bovines was described more than a century ago, but it was not until 1875 that the bacteriological study commenced with the published investigations of Dieckerhoff. Then followed the many researches of world-famous bacteriologists, including Franck, Nocard, Kitt, and Bang, names familiar to all workers on animal-diseases. These investigators found special organisms associated with the condition, organisms which could be cultivated in the laboratory and reproduce the disease in presumably healthy udders.

In present-day investigations the study of mastitis is essentially the study of the streptococci, for in 75 to 95 per cent. of the acute cases of mammitis, streptococci alone, as a group, have been incriminated. It will be presumed, therefore, that in this interpretation of the disease as affecting the dairy stock of New Zealand streptococcal mammitis is being discussed. As already mentioned, the contagious nature of the disease nowadays finds acceptance among stockowners, especially in outbreaks marked by definite acute manifestations, both local and systemic, whereas the subacute or chronic cases are often not so considered, and in many cases are not regarded even as mammitis.

The clean-milk enthusiast, the veterinarian in attendance, and the laboratory worker may view with grave concern the alarming incidence of chronic mammitis in a herd, yet there is no means at their disposal, and presumably may never be, of attaining and maintaining a relatively sterile secretion of milk from a previously infected quarter.

For the production of milk of undoubted cleanliness it is always recommended that the fore milk be discarded, since within the teat-canal, even under ideal conditions, there are to be found bacteria which presumably under suitable conditions can produce mammitis, and will most certainly contribute towards a high bacterial count if not so rejected. What then is likely to be the state of affairs under ordinary dairying

conditions where proper sterilization is not practised, and the hygienic measures suggested by common-sense are too often neglected? In introducing the question of clean-milk production the writer wishes to emphasize the means towards the end, for herein lies the secret of prophylaxis or prevention of spread of mastitis in the herd. Of course, many and diverse are the sources of contamination of the milk from the cow to the consumer, yet cleanliness at the source goes a long way towards furnishing a sample of reasonable bacterial count; nevertheless a flare-up of a chronic infection in one or two cows will very quickly contribute to a count of many millions of organisms per cubic centimetre.

It can be definitely stated that the bacterial flora of the teat-canal is governed by the extent to which hygienic measures are adopted by the producer, but infection located within the milk-sinuses results from a previous mastitis or an abortive specific inflammation. Experimental methods in various countries have established the fact that infection is usually, though not invariably, by way of the teat-canal, and therefore under the control of the producer and governed by the extent to which hygienic practices are adopted. We may assume that within the teat-canal the invading organisms are kept in check by the resistance manifested by the animal and exhibited by the secretion of the udder as a chemical or serological antagonism. The periodic suckling of the offspring, or the morning and evening milking by hand or machine, would assuredly assist in combating the invader, whereas endocrine inactivity, abnormal metabolism, or disease processes may turn the balance in the opposite direction.

The question as to whether the streptococci, &c., which invade the udder have increased in their pathogenicity towards the particular species or tissue is still a disputed point, and this accordingly permits of the idea that no such spontaneous increase in infective power occurs, but rather that the organisms gain the necessary footing under conditions exceptionally favourable for their growth. Just how far this can proceed is determined by the reserve resistance which the animal can concentrate or be made to concentrate at the seat of the bacterial invasion or activity. Any predisposing factor—and such have been too often laboured—which lowers the resistance of the animal, by impairing the tenacity of the mammary tissue, permits the organisms located within the teat, or even in the milk-sinuses, to invade the gland and to proliferate therein, without causing any solution of the continuity of the secreting epithelium, but nevertheless resulting in a definite and extensive catarrhal inflammation. The susceptibility of the animal is thus the all-important foundation on which to build a rational system of prophylaxis or cure.

Prophylaxis or Prevention of Mastitis.

Outbreaks in the earlier days would occur more readily and spread more rapidly, since the farmer was unable to appreciate the ill effects of uncleanness, or the necessary sanitary measures for prevention and control. During the last quarter of a century, however, veterinarians and stockowners have become increasingly alive to the means by which the disease is spread in the herd; yet it is difficult to realize why this advance in the knowledge of prevention has been accompanied by little, if any, improvement in curative means. The farmer has looked

in vain for any laboratory finding which could be successfully used in the field for prevention or cure, yet a considerable amount of information has been amassed and much negative work done from the bacteriological standpoint.

The problem therefore, in the light of the above interpretation, presents two and only two aspects—namely, by hygienic measures to prevent bacteria from reaching the teat-canal or milk-sinuses, and, secondly, by rational methods of management and feeding to maintain or increase the resistance of the animal. With regard to the former, it is useless for the writer to give in detail the methods advocated in all dairying countries for the prevention of mastitis in a herd, but the position may be summarized by stating that the demands for pure and clean milk production are the essential requirements for the elimination and control of the disease.

The public-health aspect of the subject has engaged the attention of the writer for many years, and it has been definitely proved time and again that attention to the details for clean-milk production has resulted in a marked decrease in the incidence of mastitis in a herd. This is all the more interesting in view of the apparent failure or doubtful success of the many laboratory specifics for treatment and prophylaxis recommended in every dairying country. Such results can be and have been repeatedly obtained under commercial conditions by adopting the usual hygienic control measures in the milking-herd.

The introduction of sterilizing plants into all dairies would do infinitely more good than the gallons and gallons of vaccines, &c., now being used for mastitis. Where milking-machines are employed the whole of the essential milking parts likely to convey infection from cow to cow must be sterilized by heat, and, in the writer's experience, a cleaner and more constant bacterial count can be obtained in the composite sample by using the milking-machine under such conditions than by hand milking even.

Now, with regard to the second and perhaps equally important aspect of the subject of prevention—namely, the rational methods of management and feeding to maintain or increase the resistance of the animal—it would appear on the surface without the control of the stockowner, but it is easy to appreciate the many ways in which the animal, or at any rate the mammary gland, may succumb to infection. Experimental proof is not wanting in most dairying countries, where attempts have been made to set up the condition experimentally, but it will suffice here to consider perhaps the most important and commonest factor in lowered resistance of the mammary gland—namely, injury, from whatever cause. This may result from accidental wounds or mechanical irritation. With regard to the former, it can be appreciated from the anatomical relationship of the udder to the animal-body that the gland is at all times exposed to the risk of injury, but since such risks are too numerous and too obvious to require a detailed survey it will be more profitable to consider only mechanical irritation.

Where hand milking is practised it is found that the bad or heavy-handed milkers are always a source of trouble. This is a well-established fact and common knowledge to owners of commercial herds. With the use of the milking-machine it has been said that the dairyman's.

trouble begins. This may or may not be so, but at any rate the choice of the milking-machine is important. Milking-machines of the pre-war days in Britain were notoriously unsatisfactory, but it can be truthfully stated that there are now many excellent types on the market. Special teat-cups are now in use which imitate in an admirable manner the grip and pressure of hand milking, and depend on the alternating pressure outside the teat-rubber in place of the original suction. Leaving the cups on too long, or working at too high pressure in speeding up, are now the commonest causes of injury to the teats, but in the writer's experience failure to strip or incomplete stripping is also responsible for at least induration of the udder, if not in many cases even mastitis. Unequal milking of the four quarters is a difficulty often met with, and one very liable to cause trouble sooner or later, especially in herds where the question of labour is important.

Finally, it need only be said that in prophylaxis rational management and judicious feeding, depending upon local conditions, is all that need be recommended here.

It is obvious, therefore, that the stockowner himself must understand the situation thoroughly, and be prepared to carry out the precautionary measures recommended, and to see that his workers do so also. It may not be the duty of the Government nor the work of the veterinarian to undertake preventive measures in order to reduce the incidence of mastitis in the country, but indirectly legislation aiming at a national clean-milk supply can materially assist by compelling the indifferent producer to adopt reasonable hygienic measures in his daily routine. In the Friesland district of Holland the position is interesting, for the farmers, the co-operative creameries, and the Friesian Herd Society have now been working for the past ten years, and entirely without Government intervention or aid, for the eradication of diseases of dairy cows, and by the same Hygienic Control Service to guarantee the quality of milk for consumption. Milk subject to the control has a bacterial count of not more than 50,000 organisms per cubic centimetre when examined at the creamery. The standard for the highest grade of whole milk in Britain—namely, Grade A (Certified)—is 30,000 organisms per cubic centimetre when delivered to the consumer in bottles. Previous to the initiation of the Hygienic Control Service referred to all the milk was pasteurized, but as the quality improved and tuberculosis was eradicated from the herds, pasteurization was dispensed with in many of the creameries, a procedure which is being aimed at in the whole of Friesland. It will be noticed that here the stockowner has become alive to his responsibilities, and in guaranteeing his produce has incidentally helped himself. Mastitis still occurs in Friesland, but according to the veterinarian employed by the Hygienic Control Service extensive outbreaks of this disease are now comparatively rare.

Treatment of Mastitis in Europe.

The writer wishes to record here the methods of treatment of bovine mastitis as employed in Europe, and to give in brief the opinions of the various workers on the subject, and more especially those who are attempting to treat the disease in the field.

Great Britain.—Director W. A. Pool, of the Animal Diseases Research Association, Scotland; Dr. J. Basil Buxton, of Cambridge;

Dr. Minnett, of the Research Institute in Animal Pathology; and Dr. W. H. Andrews, of the Research Laboratory, Ministry of Agriculture, Weybridge, have all been interviewed on the subject, and so also have the professors of the Veterinary Colleges in Edinburgh and London. The position would appear to be very unsatisfactory, but it will suffice to state that no success is claimed for vaccine treatment of mastitis. In Britain there are many proprietary preparations on the market, but from the writer's experience in many parts of Scotland and England no evidence of any value can be obtained, either supported by facts or properly authenticated, which might suggest any hope for this method of intervention. Autogenous vaccines are generally favoured by the veterinarians in the field, and accordingly such are still being prepared, as requested, by the research institutes and colleges. The data available in the research institutes are far from satisfactory, and the writer is therefore unable to furnish definite proof of this presumed failure of vaccination in Great Britain. Some workers favour killed bouillon cultures, whereas others prefer to use saline suspensions of surface growths. Auto-vaccination with treated or untreated milk from the infected quarter has not been met with in Britain by the writer. Intra-mammary injection of antiseptics is still being used, but here again with doubtful success.

Denmark.—Professors Olaf Bang, Folmer Nielsen, and Christiansen, all of the Copenhagen Veterinary and Agricultural High School, have had no success with either polyvalent or autogenous vaccines in the treatment of bovine mastitis. Intra-mammary injection of disinfectants in the hands of these workers gives indefinite results. Professor Folmer Nielsen, who has charge of the very large ambulatory clinic attached to the Veterinary College, uses Rivanol, an acridine derivative having a specific action on cocci, and Uherasan, a similar acryl derivative, and both German proprietary disinfectants; he also favours Lugol's iodine, in one to two parts per thousand. Since success is claimed for this method of treatment, it is always worth remembering that there is no way of estimating how far any line of treatment has influenced the course of the disease in a particular subject. Professor Nielsen does not enthusiastically proclaim success, but feels that since intervention is indicated and demanded in the acute cases of mastitis he can only resort to common-sense measures—namely, continual antiseptic injections, massage, and milking-out; the choice of the disinfectant is usually governed by the number of so-called specifics placed on the market, in the hope that the latest will justify the claims made for it by the manufacturers, whereas saline, boracic, or soda solution in high dilutions would perhaps have given equally good results.

Sweden.—Dr. H. Magnusson, of Malmo, and Professor Harry Stalfors, of the ambulatory clinic of the Veterinary High School, Stockholm, had no success to report with polyvalent or autogenous streptococcal or mixed vaccines, although, as in Britain, the latter are still used. Rational treatment—that is, massage and milking-out—are practised, although Professor Stalfors claims great success with intra-parenchymatous injections (into the udder substance) of Parenchymatol, also of German origin, and intra-mammary (via the teat-canal) injections of Rivanol as used by Professor Nielsen of Copenhagen.

Norway.—Professor H. Holth, of the State Serum Institute, Oslo, had nothing to suggest with regard to the treatment of mastitis in bovines. Vaccines are still used in Norway, with, again, doubtful success.

Germany.—When visiting the Berlin and Hanover Veterinary High Schools the writer had an opportunity of discussing the problem of mastitis with the professors, and would particularly mention Professor Richard Goetze, of the Hanover ambulatory clinic, who is considered the authority on mastitis in Germany both from the practical and theoretical standpoint. Professor Goetze in very acute cases tries auto-vaccination, using 40 c.c. of the milk from the infected udder, either treated by heat or disinfectants, sometimes even untreated. The injection is made subcutaneously, in the hope that some good may be derived from such injections pending the preparation of the autogenous vaccine. Three or four injections of the latter are usually employed. This procedure alone in the professor's hands has not given good results, but he points out that some success may be claimed in cows affected towards the end of their lactation, provided they can be completely dried off six weeks before calving. In other cases under his care, udder antisepsis, using Rivanol, one part in four thousand, is employed, when 1,000 c.c. to 3,000 c.c. are injected into each quarter. Under vaccination and intra-mammary disinfection the udder may appear to recover, but the disease will subsequently reappear. A six-weeks rest prior to calving must be provided in order to give the udder time to throw off the infection and to regenerate the necessary protective and secreting tissues. Dr. Karsten, of the Agricultural Society, Hanover, adopts a similar line of treatment, and claims some success.

Holland.—Dr. L. De Blicck, of Utrecht, and Dr. Veenbaas, of Leeuwarden, had certainly something interesting to suggest. The former, as Professor of Bacteriology in the University Veterinary Faculty, favoured the writer with his views on the subject from the bacteriological standpoint, which need not be elaborated here. The work bearing on the practical aspect of the control of mastitis is dealt with by the Hygienic Control Service, with its own staff of veterinarians and own diagnostic laboratory under the control of Dr. Veenbaas. Living bouillon cultures of streptococci, preferably from the same strain found on the farm previously or even in the same district, are employed as a curative. Three injections are usually given—3 c.c., 5 c.c., and 8 c.c. respectively, at fourteen-day intervals. Some success is claimed for this method of intervention. Many disinfectants have been used for intra-mammary injection, but these have been entirely given up as of no real value.

Belgium.—Dr. Leynen, Director of the Government Laboratory at Brussels, informed the writer that vaccines were being prepared there for use in mastitis. He was unable to say definitely whether the employment of these was attended with any real measure of success. As in all other countries, conflicting reports were received from the field, and would again suggest a biased opinion in cases which without vaccination would most likely have given an equally favourable result.

France.—The Professors of the National Veterinary School at Alfort, and also Professor Vallée, of the Research Institute, could offer nothing in the way of treatment of mastitis. Vaccination is used extensively

in France, but again no means of estimating the true value of such intervention is available, and accordingly a definite pronouncement is impossible.

SUMMARY.

In concluding this part of the survey of the knowledge on bovine mastitis it will be of value to summarize the opinions on the question of treatment. The following will suffice, and at the same time will complete the details which were omitted from the survey regarding the position in Europe in order to save repetition :—

(1) Early diagnosis and all that this implies.

(2) Strict hygienic measures; isolation of the affected from the apparently healthy; hand milking, every hour if possible, at least during the acute stages of the disease; disinfection of premises contaminated, and of all utensils, &c., which have been in contact.

(3) Local applications and massage.

(4) Antiseptic injections into the udder.

(5) Autogenous and polyvalent vaccines.

Other methods of treatment were met with by the writer in the course of his tour—for example, feeding with infected milk, cultures, and various chemicals—but these have only been in the experimental stage. It can therefore be said that the foregoing comprises all that is known and is being tried extensively in the field in Europe. In view of the many opinions quoted by the writer—opinions of veterinarians who have devoted many years to the study of mastitis—it is surprising to find that after more than a quarter of a century there is nothing really new to report. Vaccination was tried and found wanting more than twenty years ago, and intra-mammary injections of antiseptics—dating back to 1905, when Bigoteau experimented with injections of boric-acid solutions—have not given the results anticipated.

CONSIDERATIONS ON VACCINATION.

With regard to vaccination it is difficult at first sight to appreciate why there are so many failures. Presumably vaccines are indicated when the more chronic conditions are met with, but even in such cases results are not encouraging. The invading organisms penetrate, as is generally accepted, by way of the teat-canal, and are later located in the sinuses, and thus outside the true mammary tissue, where they can multiply and produce their toxins. The body-fluids under such circumstances, although reinforced by the presence of homologous antibodies from vaccine treatment, are unable to successfully combat the invader. Attempts have been made to cause an outpouring of serum into the sinuses by administration of various chemical agents, either by intra-mammary injection or by way of the mouth, but so far such procedures in conjunction with vaccination cannot be accredited with any great success.

It is interesting in this connection to recall that in human therapy autogenous vaccines against streptococcal infections have not given the results which had been anticipated, and the position with regard to vaccination can be correctly stated by saying that any success claimed from vaccine treatment could have been obtained with the usual methods recommended in conjunction with it.

Theoretically, the use of sera from other animals hyper-immunized against several strains of the infecting organisms would appear to be justified in all acute cases when marked systemic disturbances are manifest, but at the same time the use of vaccines would be contra-indicated as likely to do more harm than good. Anti-mammitis sera are on the market, but the writer was not able to obtain information regarding their efficacy. Polyvalent anti-mammitis serum is recommended as pre-eminently indicated as a specific means of promptly overcoming the progress of an infection, rendering what might otherwise be a severe progressive udder infection destroying the function of all or part of the udder, into a comparatively mild course.

In this direction, it may be said, lies the only hope of being able to furnish a laboratory product which will be of value in the treatment of mammitis. Whether such a product will be of use in prophylaxis is a matter yet to be investigated.

(Series to be continued.)

VACCINE TREATMENT FOR CONTAGIOUS MAMMITIS IN DAIRY COWS.

REPORT BY THE LIVE-STOCK DIVISION.

THE following statement on the present position of vaccine treatment in mammitis is based on observation of the results obtained with various vaccines over a period of several years, and is supported by experiments carried out by officers of the Department of Agriculture, with several vaccines, including those prepared in our own Veterinary Laboratory at Wallaceville. The observations cover the use of vaccines in regard to their two main points—(1) preventive and (2) curative.

Generally speaking, the results of this inquiry are supported by those of other countries, including Australia. Eminent medical authorities are agreed that vaccines (even the so-called autogenous vaccines) prepared from organisms of the class associated with contagious mammitis do not give definite results, either of a preventive or a curative nature, in the treatment of local affections. In nearly all cases where such vaccines are used in medical practice this treatment is used as an auxiliary to surgical treatment, upon which the main factors of success are based. In mammitis the main surgical treatment necessary is complete drainage of all infective material, but this cannot be obtained as with an ordinary abscess.

Like many other new treatments for the prevention or cure of disease, vaccination was acclaimed as salvation for the much-discussed mammitis. Practice changes in medicine as in other things, and when making inquiries some difficulty was experienced in collecting reliable data and figures from the farmers themselves. In many cases the farmers admitted that they were inexperienced judges. This is only reasonable to expect, for what appear to be glowing accounts in one

case may actually be considerably influenced by other factors, such as seasonal incidence of the disease due to climatic or feed conditions, or some other favourable or limiting influences.

INFORMATION SUPPLIED BY FARMERS.

The information here presented regarding the personal experiences of individual farmers has been obtained by departmental Veterinarians and Stock Inspectors in the different dairying districts throughout the North and the South Island. The herds concerned were of varying size, and the farm conditions were variable.

The data are based on figures supplied from 250 farms during the years 1925-26 and 1926-27. During the 1925-26 season these 250 farmers had a total of 11,806 cows inoculated with a well-known vaccine. From their own information, out of the 11,806 cows, 1,416 were affected with mammitis before any inoculation was carried out. The season following inoculation the total given for affected cows on the same farms was 1,414. Whereas on some farms an improvement was reported, on other farms the results were decidedly unfavourable. Furthermore, included in the 250 farms were fifty-four herds which were free from mammitis prior to inoculation. After inoculation thirty-two of these originally clean herds showed the presence of the disease in varying degree, though it is not suggested that they became infected by the vaccine. On the other hand, the figures show that twenty-four herds out of the 196 affected with mammitis at time of inoculation were clean the following season.

WALLACEVILLE EXPERIMENTS.

Some time ago experiments with vaccine were carried out at Wallaceville Veterinary Laboratory. Cows free from the disease were chosen. In the first case two cows were vaccinated and one left as a control. A month after vaccination the two first cows were inoculated with mammitis-infected material—one with culture, the other with milk from an acute case of the disease. The control cow was at the same time inoculated in the same way in two quarters, one with culture, the other with the same milk-supply. All three cows contracted the disease. These cows were watched for some months; before drying off the control cow cleared up, leaving one vaccinated animal still affected with the disease.

Similarly another six animals free from the disease were vaccinated, and one kept as a control. Four animals were mechanically infected along with the control. The control cow cleared up quickly, as did three of the vaccinated cows. The fourth vaccinated cow continued, until she dried off, to give organisms of contagious mammitis and inflammatory cells in her milk, although the milk itself was of normal colour. One of the three vaccinated cows, although apparently sound, flared up again into an acute attack just when drying off. The remaining two cows were kept in contact with the infected animals in order to ascertain whether they would contract the disease naturally. They remained healthy. All seven cows were milked by hand.

Eight herds, with a total number of 479 cows, were used in field experiments carried out from the Wallaceville Laboratory. The

vaccine used in each case was autogenous to the herd—that is, prepared from material obtained from the herd itself. It is claimed for such vaccines that if any immunity is conferred a herd-autogenous vaccine is superior to a stock vaccine. In these experiments a sample of milk was taken before inoculation and examined under the microscope. After inoculation from five to seven samples of milk were taken from each animal during the milking-period. As a result of these examinations no apparent improvement was shown in the vaccinated animals over the control animals. In the herds mentioned 216 animals were left as controls, the remaining 263 being vaccinated. Percentages have been worked out in each herd, but these percentages do not show anything in favour of vaccination. The herds were representative ones chosen in the Wairarapa, Taranaki, and Hamilton districts.

Apart from the foregoing, a considerable amount of experimental work has been done with vaccines prepared at Wallaceville, but none has given satisfactory results.

DECLINE IN USE OF VACCINE.

A significant fact in connection with the farm data quoted above is that although 11,806 cows were inoculated in the season 1925-26 only 1,352 of these cows were again inoculated in the following season 1926-27. The majority of these cows were animals still affected, and were inoculated free of charge to the owner.

Reports received during the 1927-28 and 1928-29 seasons indicate that the total number of inoculated animals in each district has shown a gradual reduction throughout the country, until at the present time only a comparative few are being treated. At the present time the vaccine used is sold direct to farmers, who do their own inoculations.

This Department has always advised farmers (when asked for an opinion) that it did not consider vaccines reliable either as a cure or as a preventive of mammitis, and the above-quoted figures, together with a mass of evidence of a more general nature, backed up by a thorough knowledge of immunology against organisms of the type concerned, and from controlled experiments carried out by veterinary specialists, give the Department no warrant for altering its original opinion.

OPINION OF AUSTRALIAN AUTHORITIES.

The following cablegrams, recently received by this Department in response to inquiries, give the opinion of State Veterinary authorities in Australia regarding the use of vaccines for mammitis :—

Official experience with commercial vaccine indicated not extensive in Victoria. Test on forty-seven cows, of which twenty-four affected and twenty-three non-affected before inoculation, conducted under expert observation. Subsequent to inoculation number affected reached thirty-three; nine only remained non-affected; meanwhile five sold. Departmental opinion on value of vaccine is adverse. No knowledge of results of use in New South Wales or Queensland.—CAMERON, Director of Agriculture, Victoria.

Your cablegram commercial mammitis vaccine. Personal opinion it is no use as prophylactic, and doubtful whether of any material curative value. Department does not favour use proprietary vaccines, and has issued regulation accordingly.—CORY, Chief Veterinary Officer, Stock Department, Queensland.

On general question of use of vaccines against contagious mammitis this Department considers they are of value chiefly from prophylactic standpoint. The

only vaccines recommended by this Department are those manufactured by Commonwealth Serum Laboratories, Royal Park, Melbourne.—HENRY, Chief Veterinary Officer, New South Wales.

GENERAL.

Information recently published by the Department of Agriculture regarding the experience with vaccines in European countries and in the United States, where similar vaccines were used for mammitis, supports authoritative opinion in this country.* In the article referred to emphasis was laid on the necessity of cleanliness, &c., in the prevention of the disease, and in the meantime this must be the farmer's sheet-anchor, combined with fomentation, massage, and stripping, as advised in the Department's Bulletin No. 141.

It is quite apparent from the numerous experiments carried out that no active immunity is conferred by vaccination. Cases have come under notice where some passive assistance may have been brought about, but this is apparently of an unstable nature and soon leaves the system. This may account for some of the apparent good results obtained, at the same time showing the very disappointing results obtained in other cases.

Dead vaccines have been proved useless for the control of contagious abortion. The vaccine used in connection with mammitis is a dead vaccine. The agglutination test is unreliable in mammitis as a guide to show antibody-formation in the blood. One must therefore depend on the clinical recurrence of the disease after inoculation, confirmed by microscopic examination of the secretion of the gland. There has been no evidence brought forward, either scientifically or in the field, under general farm conditions, to show that dead vaccines are of real value in the control of contagious streptococcic mammitis.

At present this Department is carrying on a series of "herd-autogenic" vaccinations over a number of seasons, with a view to ascertaining if any cumulative beneficial effects result from so doing.

* See also Mr. Hill Motion's observations on pages 240-242 of this issue.—ED.

Bonus for Destruction of Keas.—For the official year 1928-29 the Department of Agriculture paid a total of £748 10s for 2,994 beaks, at 5s. per beak. From 17th July, 1929, the bonus payable by the Department has been reduced to 2s. 6d. per beak.

Farm Dairy Instruction.—The annual report of the Dairy Division for 1928-29 makes the following remarks on this subject: "Although those dairy companies which are co-operating with the Department in the employment of Farm Dairy Instructors—whose principal duties are along the line of assisting suppliers to produce and deliver to the factory a high-quality milk or cream—have improved the quality of their produce the scheme requires to be on a wider basis in order to effect the desired result throughout the whole Dominion. Combined with cream-grading, universal dairy instruction is the desideratum to be aimed at, and dairy companies are again urged to give this matter their serious consideration. The efficient manner in which the officers at present engaged in this work have carried out their duties is freely commented on, and most of the companies employing them have experienced an improvement in the grade of their products. During the year forty Farm Dairy Instructors were employed, as against thirty-one during the previous year, thirty-six being in the North and four in the South Island."

HANDLING OF EXPORT APPLES AND PEARS.

INVESTIGATION OF MATURITY, STORAGE, AND TRANSPORT CONDITIONS IN 1929 SEASON.

Horticulture Division.

DURING the fruit-export season of 1929 a wide range of practical experiments was undertaken by the Department of Agriculture, in conjunction with the Department of Scientific and Industrial Research, to gather data on various problems of cool storage and transport overseas. Early in the year, to coincide with the commencement of export, an officer of the Horticulture Division was detailed to carry out the selection and consignment of experimental cases of apples and pears for transhipment on vessels carrying fruit cargoes under refrigeration.

The twelve experimental lots of selected fruit, consisting of pears and apples were divided into two portions, half the quantity in each instance being exported, while the remaining half was retained and held in Dominion cool stores as controls on those shipped. The following matter shows that interesting facts of economic value have resulted from the storage and periodical detailed inspection of the fruit held in New Zealand.

SELECTION OF FRUIT FOR EXPERIMENTS.

This was carried out with due regard to conditions appertaining to commercial methods. The fruit to be used for experimental purposes was packed from lines passing over the grader at the time under the grades of Extra Fancy and Fancy. Good sound lines of fruit were chosen, but no special elimination of defects which may have existed was practised. By this method a fair sample of export fruit was placed under trial.

In order to further include commercial conditions all control fruit was shipped by coastal steamer to the port of loading for overseas transport, and returned for storage. This process really meant that control fruit received one more handling than fruit exported.

CONDITION OF MATURITY.

This aspect was given special consideration. Three lots of Cox's Orange Pippin were selected from the same orchard and trees, with intervals of ten days between each picking. This method was adopted in order to ascertain more specially the influence of maturity over bitter-pit, which is particularly prevalent in this variety. Worcester Pearmain was also under consideration from this aspect, two pickings being made from the same trees with an interval of eight days. The four consignments of Jonathan and Sturmer Pippin apples also gave a wide range of maturity for the varieties.

One line of P. Barry pears was kept in cool-shed storage for a period of three weeks prior to packing, in order to ascertain the influence of such storage on ripening; and one line of this variety of pear from the same orchard was packed and cool-stored straight from the trees.

IODINE TEST FOR MATURITY.

This system of ascertaining maturity by chemical conversion was applied to three lots of Jonathan apples, three lots of Cox's Orange Pippin, one lot of Worcester Pearmain, and one lot of Winter Nelis and P. Barry pears. The results obtained by this test fully justify the assertion that the iodine solution can be relied on to indicate the progress of starch conversion to sugar during the process of ripening. Unfortunately a weakness in the test asserts itself—namely, that if a natural deficiency in the starch content of individual fruits exists, the results given by the iodine solution are similar to those resulting from starch conversion. Individual apples grown in pronounced shady positions in the tree have proved to be of exceptionally low starch content.

COOL-STORAGE TEMPERATURES.

In order to ascertain the influence of temperatures on wastage, the fruit retained in New Zealand was stored at two points, thereby obtaining chambers maintained at temperatures of 32°, 34-36°, 36-38° F., and one chamber with temperatures fluctuating from 32-50°, with an average of 40°. Various positions in the chambers were selected, so that influences in this respect could be noted.

EXAMINATIONS.

The first detailed inspection made was in each instance of one-half of each case at a date to coincide with the arrival at port of destination of each ship carrying export fruit with experimental consignments, each case of fruit being divided in half equatorially. In order to determine any differences effected by some of the fruit being adjacent to the sides or ends of the cases, each apple in the cases was wrapped in a paper bearing a printed number which indicated the exact position of individual apples, so that this aspect could be checked. The examination of the remaining half of the fruit was made twenty-one days after the first examination. It was considered that twenty-one days fully represented the time fruit would be likely to be held after arrival and before consumption overseas.

During the period which elapsed between the first and second examination the fruit was kept in a room at the Department of Agriculture's offices at Wellington, with temperatures ranging from 60-70° F. This procedure was adopted to ensure storage conditions similar to those obtaining in overseas salerooms and domestic storage. A quantity of the fruit was cut at each examination, in order to determine the percentage of wastage occurring through flesh-collapse, mouldy core, bitter-pit, and other internal troubles.

NOTES ON CONDITION OF EXPERIMENTAL FRUIT.

A detailed analysis has been made on the condition of each case at the time of inspection, summarized results of which are here given. In reviewing the percentages of wastage shown as per tables attached one is confronted with what appears to be an inconsistency of results, which is not only perplexing but seems to make it impossible to come to any conclusions concerning the temperatures

most desirable for successfully maintaining fruit in good condition. However, considerable light can be thrown on the figures by explaining in some detail how these wastages apply, and it will be seen that various temperatures have had a direct bearing on the different results experienced.

Experiment No. 1: Worcester Pearmain Apples.—At first examination the small amount of wastage experienced was confined to fungal rots, a condition which was fairly uniform at all three temperatures. At the second examination fungal rots had increased in about equal proportion, with bruises, rotting, and Jonathan spot in evidence. The fruit stored at 32° showed the best condition at first examination. This condition was not maintained in subsequent storage, bruise rotting tending to equalize the wastage at final examination. The condition of the fruit stored at 34–36° and 31–50° was much superior for dessert purposes to that stored at 32°.

No. 2: Cox's Orange Apples.—At the first examination the prevalence of bitter-pit raised the percentage of wastage in fruit stored at temperatures of 31–50°; this feature did not occur at 32°. An increase at the same proportion was found at the time of the second examination. Fungal rots were also in evidence at the higher temperatures. The general condition of the fruit kept at temperatures of 34–36° was most desirable, wastage being approximately the same as that kept at 32°, while the quality for dessert purposes was superior to that kept at 32° and 31–50°.

No. 3: Worcester Pearmain Apples.—A small percentage of fungal rots represented the wastage in this experiment at the first examination. At the second examination fungal rots were pronounced in the fruit kept at 31–50°, with a smaller percentage showing in the second half of the case kept at 32° than at the first examination. Unfortunately, owing to abnormal treatment, the fruit kept at 34–36° was of no value for comparison.

No. 4: Jonathan Apples.—The wastage occurring in this experiment was so small that the results may be regarded as most successful, with economic loss negligible. It was noted that a small percentage of indeterminable rots took place in a chamber where there was excessive handling.

No. 5: Cox's Orange Apples.—At the first examination the fruit at 31–50° was in the best condition. The fruit at 34–36° had been inadvertently taken out of cool store nine days earlier than the rest of the fruit, which probably resulted in a higher percentage of fungal rot than would otherwise have taken place. The wastage in the fruit kept at 32° and 31–50° was not serious. At the second examination fungal rots were more pronounced in the fruit stored at 34–36° and 31–50°. In one case of fruit stored at 32° bitter-pit, soft scald, and flesh-collapse were slightly in evidence. In almost every instance where bitter-pit occurred the individual apples were green and immature.

No. 6: Jonathan Apples.—The small amount of wastage occurring in this line of fruit was confined to rotting of punctures.

No. 7: Cox's Orange Apples.—At both examinations a small percentage of wastage in the category of fungal rots existed in fruit stored at temperatures of 34–36° and 31–50°. The disastrous effect of a temperature of 32° or under is shown by the percentage of wastage

shown at each examination—namely, 44 per cent. and 46 per cent.—this wastage being practically confined to soft scald and flesh-collapse following soft scald.

Jonathan Apples.—The effect of too low a temperature was again emphasized, the high percentage of wastage at a temperature of 32° or slightly under resulting from flesh-collapse. Scald was not apparent

Table 1.—Showing Percentages of Wastage in Experimental Lots under various Storage Temperatures

Experiment No.	First Examination.				Second Examination.		
<i>Worcester Pearmain</i>							
	32'	34 36'	31 50' (Average 40')	32"	34 36'	31 50' (Average 40')	
1	1.05	3.8	3.3	13	13.8	14.1	
3	1	2.1	5.9	1.6	..	27.9	
<i>Cox's Orange Pippin.</i>							
2	1	1	10	2.5	3	20	
5	4.7	8	2.8	9	2.7	12.5	
7	44	2.4	3	40	3.4	1	
<i>Jonathan</i>							
4	Nil	Nil	0.56	0.51	Nil	2.04	
6	1.23	Nil	Nil	1.35	2.13	0.67	
7	25.6	3.5	2.1	26.0	11	2.2	
8	43.5	Nil	1.6	35.8	Nil	4.3	
<i>Sturmer</i>							
		36 38°			36 38°		
10	2.3	1.6	0.66	2.8	1.65	0.66	
11	Nil	0.55	..	28.77	9.27	..	
12	0.56	0.55	..	5.84	5.77	..	
<i>P Barry</i>							
		31-36°			34-36°		
9	..	Nil	..	..	15.7	..	
9	Nil	Nil	..	16.6	27.25	..	
<i>L'Inconnue</i>							
9	..	Nil	..	..	14.8	..	

Table 2.—Showing number of Apples affected with various Defects under different Temperatures.

Punctures.						Fungal Rots.			Bitter-pit.			Flesh-collapse and Scald.		
Sound.			Rotted.											
32°	34-36°	31-50° (Average 40°)	32°	34-36°	31-50° (Average 40°)	32°	34-36°	31-50° (Average 40°)	32°	34-36°	31-50°	32°	34-36°	31-50°
110	103	102	19	16	31	56	86	75	22	20	24	507	23	6

Notes.—While no given temperature shows to great advantage under the heading of punctures, it is suggested that the large number of punctures not rotted may be attributed to low humidity. No given temperature shows to any advantage under the heading of bitter-pit, but striking evidence is shown of the disastrous effect of too low a temperature in connection with flesh-collapse and scald.

in this variety. Bruises had also started to break down, a condition not existing in the cases stored at 34–36° and 31–50°, where the bruises had dried out.

No. 8: Jonathan Apples.—Flesh-collapse and soft scald were responsible for the high percentage of wastage occurring in this experiment at a storage temperature of 32° and possibly slightly under. The absence of wastage at as high a temperature as 34–36° at first examination was satisfactory, especially with fruit in such fine dessert condition. From a commercial standpoint, however, such a high temperature delivers the fruit in too ripe a condition for extended storage, as indicated by the high percentage of wastage existing at second examination, such wastage being represented by fungal rots.

No. 9: P. Barry and L'Inconnue Pears.—Excellent results were obtained at all temperatures up to the time of first examination, the condition of the pears in all cases being good. The wastage at the second examination was consistent with that experienced in Experiment No. 8.

No. 10: Sturmer Pippin Apples.—This was an excellent consignment, showing no material wastage. The gradual increase in wastage towards the lowest temperature is worth noting. This fruit was kept under observation for some time after the second examination, and that stored at 32° developed flesh-collapse badly, while that stored at the higher temperatures was not affected.

No. 11: Sturmer Pippin Apples.—The high percentage of wastage observed at the second examination in fruit stored at a temperature of 32° was entirely confined to flesh-collapse. Fungal rots and puncture decay experienced at temperatures of 36–38° did not represent such a serious wastage as caused by flesh-collapse at lower temperature. The condition of the fruit at the higher temperature was much superior to that kept at the lower temperature.

No. 12: Sturmer Pippin Apples.—Wastage before and after twenty-one days out of cool store was equal. The quality of the apples kept at the higher temperature was superior at both examinations.

GENERAL INDICATIONS.

The detailed analysis which has been made in connection with examinations indicates—

(1) That low humidities exert a great influence in controlling fungous diseases and fungal decay, especially where punctures exist.

(2) That different varieties of fruit are best kept at different temperatures.

(3) That low humidity sufficient to create shrivel protects fruit from flesh-collapse.

(4) That bitter-pit is associated with immature fruit.

(5) That scald and flesh-collapse are associated with low temperatures.

REMARKS.

Only those defects rendering fruit unmarketable have been dealt with in this report. One exception has been made—namely, where punctures not rotted have been recorded.

The extent of the experimental work described will be appreciated when it is stated that detailed inspections were made of over 12,000 individual fruits kept under observation.

LUCERNE IN WHANGAREI DISTRICT.

SUCCESSFUL ESTABLISHMENT ON VOLCANIC LAND.

C. J. HAMBLYN, B.Agr., Instructor in Agriculture, Whangarei.

DURING the course of a discussion on the growing of lucerne, at a winter farm-school held at Whangarei in 1925, several local farmers present gave an account of failures they had experienced in trying to maintain a satisfactory stand after about two years, attributing the dying-off of the lucerne to the stiff clay subsoil and strong weed competition, the latter particularly in the winter. A request was made that the Department of Agriculture should set up a co-operative field experiment in the district, with the object of establishing, if possible, a lucerne stand on a representative area of volcanic soil in which the clay subsoil was typical of the areas on which failures had been experienced.

Accordingly an experimental plot of $1\frac{1}{2}$ acres was selected on the farm of Mr. G. S. B. Morrison, at Maungatapere, some eight miles from Whangarei, the soil being a fair-quality volcanic loam, overlying a stiff and somewhat hard clay subsoil about 18 in. below the surface and several feet in depth.

After being double-disked to break up the sod, the area was ploughed out of old pasture in August, 1925. During September the land was disked and harrowed, and ground carbonate of lime applied at the rate of $1\frac{1}{2}$ tons per acre. A crop of weeds was then allowed to grow, and the plot was finally prepared for sowing at the end of October. A few days before sowing 2 cwt. per acre of inoculated soil from an old stand was broadcast in the evening and lightly harrowed in. The area was then rolled and sown in 7 in. drills with 15 lb. of Marlborough seed per acre, the fertilizer used being 6 cwt. per acre of the following mixture: Superphosphate, 4 cwt.; blood-and-bone, $1\frac{1}{2}$ cwt.; sulphate of potash, $\frac{2}{3}$ cwt. The area was then harrowed again.

During the past four years careful records have been kept of the treatment and yields of the plot, an account of which is here given.

FIRST YEAR.

From the time the seed was sown, on 11th November, 1925, until the end of January, 1926, there was practically no rain of any consequence, November being a particularly dry month. The strike was consequently a poor one, though seeds continued to germinate for at least three months after sowing. The plot was cut at the end of February to prevent seeding of the annual weeds, which were very thick. The cut material was carted off, and no further cuts were possible during the first year owing to the dry weather. The plot was tine-harrowed after the first cut, and again at the beginning of winter, by which time the lucerne gave more promise.

SECOND YEAR.

The plot was top-dressed on 6th September, 1926, with 5 cwt. super and 1 cwt. sulphate of potash per acre, and on half the area twenty

loads of well-rotted cowyard manure were carted out and spread. The effect of this cowyard manure was most marked in the first and second cuts of lucerne. The whole area was then well surface-cultivated with a small spring-tooth cultivator and closed. The lucerne started into vigorous growth, tillering out and covering the ground well, and was ready to cut in the first week in December. This cut yielded over 2 tons of fairly clean hay per acre. A second cut of 2 tons was taken on 13th January, and the area cleaned up with the light cultivator. The third cut, of $1\frac{1}{2}$ tons per acre, was made on 12th February, being very clean. A fourth cut, of about $1\frac{1}{2}$ tons, was made on 30th March, when the area was again well cultivated. During April good growth was made by the lucerne, which was practically free from weeds, this growth being fed off by test cows and calves. On 30th May the second half of the area received cowyard manure.

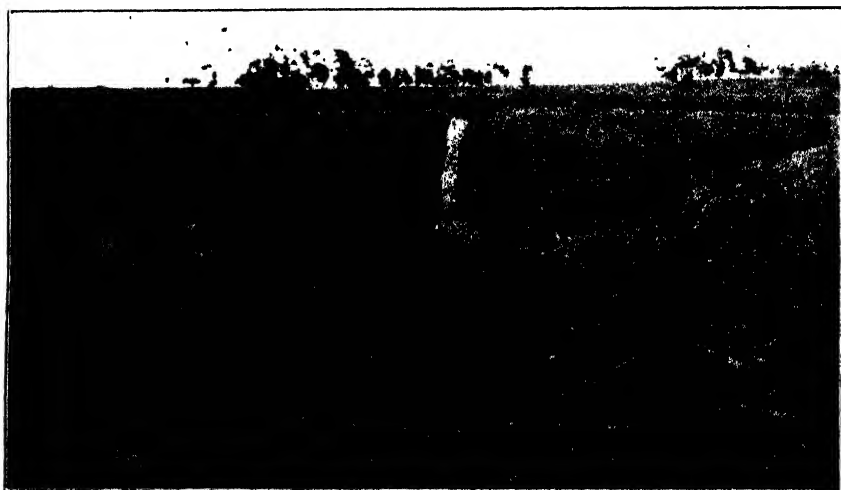


FIG. 1. GENERAL VIEW OF LUCERNE DEMONSTRATION PLOT ON MR. MORRISON'S FARM, WITH TYPICAL STONY VOLCANIC LAND IN FOREGROUND.

THIRD YEAR.

On 29th August, 1927, the plot was top-dressed with 4 cwt. super and 2 cwt. sulphate of potash per acre. On 14th September it received two strokes of the spring-tooth cultivator. The first cut, on 1st December, gave $1\frac{1}{2}$ tons of hay per acre. On 8th December another stroke of the cultivator was given. The second cut, made on 6th January, gave a poor crop of 1 ton per acre, on account of the very dry season. As weeds were getting bad the plot was cultivated again on 24th January, after which little growth was made until good rains fell in the middle of March—the first good fall since December. A fair cut of $1\frac{1}{2}$ tons was secured on 14th April, after which the plot was again cultivated, and grazed with twenty-two calves for a week in May. On 23rd May oats were sown after surface-cultivation with the spring-tooth cultivator, with a view to providing an effective smother for winter weeds, but small birds prevented a crop being secured.

FOURTH YEAR.

During August, 1928, and again on 14th September, the spring-tooth cultivator was used effectively to clean up the plot. The first cut was made on 24th November, giving 2 tons of fairly clean hay per acre. On 1st December the plot received 4 cwt. of super per acre, together with 1 cwt. of sulphate of ammonia. A second cut was made on 14th January, giving $2\frac{1}{2}$ tons of hay per acre (the best recorded for the plot). After each cut the plot was cultivated once.



FIG. 2. TAKING A CUT ON THE THREE-YEAR-OLD STAND.

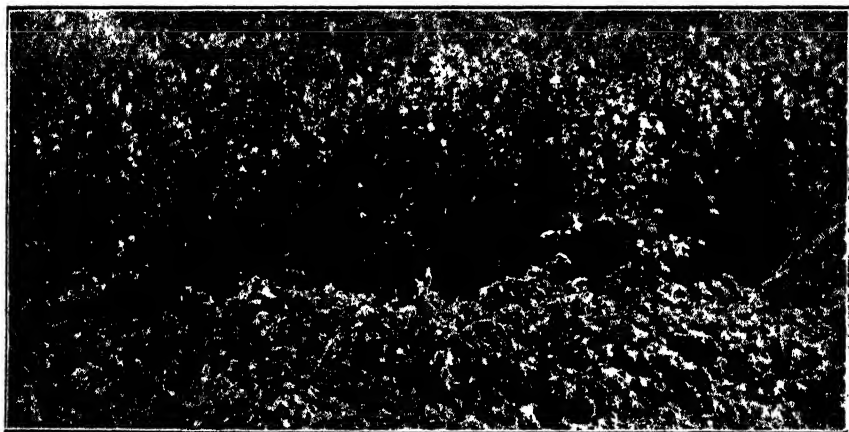


FIG. 3. A FACE OF THE SECOND CUT IN FOURTH YEAR—JANUARY, 1929.

No improvement in growth or yield was shown for the sulphate of ammonia, as against check strips not sown with this fertilizer. The plot was again ready to cut by the middle of February, but was used from then on to the end of the season to provide green feed for seven test cows. Mr. Morrison considers lucerne ideal for this purpose; it is his opinion that he secured as green feed the equivalent of two further good cuts in the autumn.

CONCLUSION.

In August last, the stand was coming to its fifth season strong and healthy, and, beyond the initial disadvantage of a rather thin and patchy strike, compares favourably with stands in other parts of Auckland Province. Though one may safely say that lucerne can be grown under the soil and other conditions outlined at the beginning of this article, the details give an indication of the care and management required to get an average of from three to four cuts per annum. They will no doubt assist other farmers in deciding whether they are in a position to make use of the many undoubted advantages of lucerne as a crop.

Of the more troublesome weeds of lucerne in the stand *Poa pratensis* and *paspalum* appear to be the worst, the latter having to be continually grubbed out to keep it in check.

Thanks are due to Mr. Morrison and his sons for their able assistance and hearty co-operation with the Department in carrying out the trial.

CHEMICAL ERADICATION OF RAGWORT.

R. E. R. GRIMMETT, Chemistry Section, Department of Agriculture, Wellington.

AN experiment on the control of ragwort, recently carried out by Mrs. Taylor and Mr. E. H. Brain, of Kaharoa, Rotorua, in collaboration with the Chief Chemist and assistant officers of the Chemistry Section, has met with a sufficient measure of success to warrant the publication of tentative conclusions.

The method, which was tried on a small scale last summer and has been adopted more extensively this spring, consists in preparing a mixture of equal parts of finely crystallized sulphate of iron and agricultural salt, about an ounce of which is placed in the dry state on the crown of each plant. It is probably more effective in the spring when the plants are young and tender, and when each shower dissolves some of the mixture, washing it repeatedly into the crown and roots.

Some dozens of plants which had been thus killed were recently seen by the writer at intervals of time varying from a few days up to some months after being treated. In all cases the plants appeared completely dead and many were easily lifted out, the roots being rotten. No regrowth from the same roots was noticed. In most cases a ring of grass, varying from a few inches to a foot in diameter, has also been killed, but this was quickly replaced by tillering from adjacent grass-roots.

Although this particular farm had only a light infestation, it is safe to say that by the method adopted the ragwort has not only been held in check but has been noticeably reduced. The original formula suggested by Mr. B. C. Aston was one part sulphate of iron to three parts of common salt, but the experiments reported above suggest that a greater proportion of sulphate of iron is advisable. Further experiments are now being designed and supervised by the writer to ascertain the cost of treating extensive and heavily infested areas, and whether the proportion and methods may be improved upon.

PREVENTION OF HYDATID DISEASE IN MAN AND ANIMALS.

Live-stock Division.

HYDATID disease in man and animals can be controlled in New Zealand if reasonable care is taken by all owners of dogs and a general attempt is made by farmers. Although the disease is present in our domestic animals, especially sheep, cattle, and pigs, seldom do deaths result from its presence. On this account farmers often treat the matter lightly. In the human subject, on the other hand, hydatid disease is, owing to its nature, often a most grave problem, requiring prolonged attention in hospitals and often serious operations. The results of operation depend on the situations of the lesions, and as a certain proportion of the lesions are recurrent a percentage of cases prove fatal.

In any country where sheep, cattle, and dogs are numerous, and where the dogs come in contact with human beings, the risk of hydatid disease in the latter is greatly increased. In different countries the disease is of varying importance, and it is a reflection to some extent on the management of dogs and the hygienic habits of the people. The farmer's dog and other country dogs, on account of their close association with stock, are more susceptible to parasitic infestation with the tapeworm, which is the cause of the disease in man and animals.

Hydatids is the term applied to the formation in the body of a thin-walled sac containing watery fluid. Once infection has gained entrance to the human or animal body these cysts may form in any organ, the most common sites being the liver and lungs. Such cysts have been found in the muscular wall of the heart in cattle and in many other situations. The cyst is the intermediate stage in the development of a tapeworm of the dog, and man and animals are therefore the intermediate hosts in the life-history and development of this tapeworm. Man and animals become infected from the eggs of the tapeworm which are voided in the droppings of the dog. Therefore if infested dogs contaminate vegetables or drinking-water, or in any other way—through the dust of their coats, through fondling by children, and through their close association with man in general—expose the human subject to infection, the necessity of taking precautions to prevent such infection is at once apparent. The infested dog is the sole distributor of hydatid disease in man and animals, and it is quite apparent that cattle and sheep, through the pasture which is subject to contamination by dogs, are susceptible to infection. Pigs are also liable to be infected if allowed to range over contaminated pastures, or in the vicinity of dog-kennels.

The parasite responsible for the spread of hydatids is a small flat worm, a tapeworm known as *Taenia echinococcus*. It lives in the intestine of the dog, is about $\frac{1}{4}$ in. in size, and large numbers of eggs are passed in the dog's excrement. These eggs are so small as to be invisible to the naked eye, and when dried are liable to be carried on the coats of dogs and in many other ways, contaminating pastures

and conveying infection to the human subject. It will therefore be easily seen why so many more cases occur with country people than with town dwellers. Country dogs are more liable to become infested than city dogs and hence spread the infection to man and animals.

Dogs can only be infested with the tapeworm by eating the raw offal of animals which contains the hydatid cyst. On sheep-farms and in the vicinity of abattoirs and meat-works if dogs are allowed

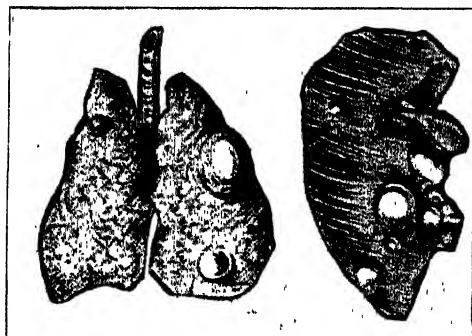


FIG. 1 SHOWING HYDATID CYSTS IN LUNGS OF SHEEP.



FIG. 2. HYDATID TAPEWORMS AS DEVELOPED IN DOG.

Above—actual size ; below—tapeworm enlarged, showing eggs in terminal segment on right.

[Drawings by courtesy of Sir Louis E. Barnett.]

access to affected lungs or livers, &c., the cysts with the immature tapeworm heads are swallowed, and as a result the dog later becomes infested with numerous adult tapeworms. Here, then, is the completion of the life-cycle of the tapeworm parasite. The tapeworm in the small intestine of the dog attaches itself by means of suckers and hooklets to the wall of the bowel and when it becomes adult numerous eggs are passed in the excrement. These eggs are the source of infection for man and animals.

PREVENTIVE MEASURES.

Seeing that the dog is the agent in disseminating hydatid disease, everything practicable should be done to lessen its opportunity for harm in this way.

(1) Never let dogs feed on raw offal. If this rule were strictly observed on farms, sheep-stations, in the vicinity of country slaughter-houses, abattoirs, and freezing-works, the dogs could not become infested. If such offal is required for feeding dogs it can be rendered harmless by boiling before use.

(2) Make an effort to kill and eradicate the hydatid tapeworms which have already obtained lodgment in the intestines of dogs that have eaten infected offal. To eradicate the tapeworms it is first necessary to fast the dog for twenty-four hours. Tapeworms are more difficult to deal with than round worms, but the following agents are recommended as effective in their results:—

- (a) Arecoline hydrobromide in a dose of $\frac{1}{8}$ to $\frac{1}{2}$ grain, depending on the size of the dog—a terrier $\frac{1}{8}$ grain, a big sheep dog $\frac{1}{2}$ grain. The pellet or powder is dissolved in about a dessertspoonful of water and given by the mouth. This drug only expels and does not kill tapeworms, therefore care must be taken to see that the fæces expelled are rendered harmless.
- (b) Liquid extract of male fern in doses of $\frac{1}{4}$ to 1 fluid dram, depending on the size of the dog. The dog should be prepared by giving a dose of castor-oil, and the day following the action of the drug the animal should be again purged in order to expel all the dead tapeworms.
- (c) Freshly ground areca nut is often used in doses of 2 grains per pound body-weight of the dog to be treated. Areca nut contains arecoline as the active principle, and is not quite so reliable as the pure drug. It is important to have the areca nut freshly ground. Arecoline is usually 100 per cent. efficient, but areca nut is less efficient. When this powder is given it is sometimes incorporated in butter, and the dog swallows it without the necessity of much dosing.

One treatment with arecoline should be sufficient, but dosing two weeks later is recommended to expel any further tapeworms which had entered about the time of dosing and had not been acted upon. In the case of male fern and areca nut it is advisable to dose every six months. After a dog is dosed with the vermifuge medicine it should be chained up for two days and its fæces incinerated in a fire preferably lit on the contaminated area.

(3) Beware of swallowing the eggs of the hydatid tapeworm. In this connection the fondling of dogs by human beings is not without risk, as the dog's coat is liable to contain numerous eggs of the parasite. Infection from hand to mouth is obviously easy, and in children dirty hands may thus convey hydatid disease. The habit dogs have of licking their human companions' hands, faces, or food utensils is of course objectionable and should be checked. It is possible for human beings to become infected by eating uncooked vegetables such as watercress, lettuce, celery, and so on grown in a place open to canine

contamination. Needless to say, such articles of diet should be scrupulously washed in filtered or boiled water. Flies may act as carriers, and food should always be protected.

Lastly, it is to be remembered that a united effort on the part of dog-owners to reduce the incidence of hydatid disease in man will also considerably reduce it in animals, with, in consequence, less risk of the treated dog becoming reinfested. If the precautions here indicated are persevered with over a number of years this disease could be materially reduced if not entirely eliminated.

INSECTS INFESTING OPOSSUM-SKINS IN NEW ZEALAND.

A. F. CLARK, Forest Entomologist, State Forest Service.

THE trade in opossum-skins has now reached a point when the export value of the pelts annually shipped from New Zealand is in the vicinity of £100,000. The animals are popularly known as "opossums," though in reality they belong to the family *Phalangeridæ*, three species of which are recorded by Cockayne* as having been liberated in the Dominion. The animals have become acclimatized and spread through many of the forest areas in both the North and South Islands. Trapping takes place during the winter months, and the great majority of the skins are graded, sold, and shipped from two centres—Wellington and Dunedin.

The attention of the writer was directed to insect damage occurring in the skins at Dunedin. In the fur industry all such insect damage is ascribed to the "weevil," and skins showing signs of such damage are said to be in a "weevilly" condition. From a superficial examination of the skins it was at once apparent that the term "weevil" was a comprehensive one and the damage not the work of one insect, but in many cases several insects were or had been present.

From skins in a so-called weevilly condition the following insects have been bred out: *Monopis ethelella* (Newm.), *Trichophaga tapetiella* (L.), *Dermestes vulpinus* (Fabr.), *Dermestes lardarius* (L.), *Ptinus fur* (L.), *Anthrenus musaeorum* (L.).

Monopis ethelella is a fairly common species of moth occurring throughout New Zealand as well as in Australia. According to Myers† (1922) it has been bred from the wool of dead sheep, and is found from sea-level to an altitude of 4,000 ft.

Trichophaga tapetiella is one of the introduced clothes-moths, three species of which are found in New Zealand, and is recorded fairly frequently in dwellings and storehouses.

The remaining insects are all beetles, and are cosmopolitan in their distribution, attacking a wide range of stored products in many parts of the world. So far as can be judged the main damage is caused

* L. COCKAYNE: Monograph on the New Zealand Beech Forests, Part II.

† J. G. MYERS: Notes on the Life History of *Monopis ethelella* (Newm.). N.Z. Journal of Science and Technology. Vol. V, No. 4, pp. 208-9.

by the *Dermestes vulpinus*, which eat out holes in the hides, *Dermestes vulpinus* being the commoner of the two.

The eggs of *Dermestes vulpinus*, which are white, shining, and tapering, are laid in a crevice or a similarly sheltered spot. Upon hatching they produce a white active larva, which changes to a darker brownish colour in a few hours. Feeding in the larval stage is rapid and growth correspondingly so, until when fully grown the larva (Fig. 1) is a stout brownish-black grub measuring some 12-14 mm. (about $\frac{1}{2}$ in.) in length, having the posterior abdominal segments tapering to a blunt point with a pair of spike-like projections. The dorsal surface has a lighter longitudinal stripe and is covered with a complex clothing of hairs of varying lengths. In the fully fed state the larva occasionally burrows into solid material, such as wood,* before pupation, but usually transformation to the soft white pupa takes place in a convenient crack or hiding-place. The time occupied in completing the preadult development varies very considerably with atmospheric conditions, but under favourable conditions the adult form is reached in six to eight weeks.

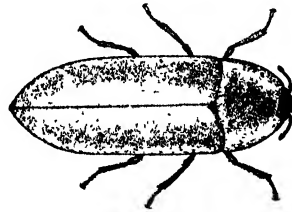
FIG. 1. LARVA OF *DERMESTES VULPINUS*.

FIG. 2. ADULT. BOTH ENLARGED.

[A. F. C. del]

The beetle (Fig. 2) is from 10-12 mm. (rather over $\frac{1}{2}$ in.) long, greyish-black in colour, with a fine yellowish pubescence most noticeable upon the dorsal surface of the head and sides of the prothorax and elytra. The ventral surface is closely covered with silvery white hairs, and has a series of darker lateral spots due to the absence of this pubescence. The inner edges of the elytra bear a small spine. The adult beetle flies but weakly, and the infestation of the insect is spread by this means and by the wandering of the larva in the early and late stages of development.

The actual aggregate damage caused by the insects was not, according to Mr. H. Roche, of the State Forest Service, apparently large during the 1928 season. The moths can be well controlled with paradichlorobenzene or flake naphthalene, both of which substances are more effective if the material to be treated is confined in a closed space. Fumigation with carbon bisulphide will control all the insects without damage to the pelts.

Pelts which are not infested and which have to be kept for some time can be adequately protected by placing them in cool storage at a temperature of 40° F. The keeping of storage-houses free as far as possible from debris and litter is an essential.

* D. MILLER: Forest and Timber Insects in New Zealand, State Forest Service Bulletin No. 2, p. 55.

GRAPE-VINES FOR NEW ZEALAND CONDITIONS.

FURTHER TEST IMPORTATIONS FROM EUROPE.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division, Wellington.

IN continuation of the policy of introducing and testing varieties of vines with regard to their suitability for culture in New Zealand, a further number of European varieties, as scheduled below, have been recently imported by the Horticulture Division. A list of previous importations was given in the February, 1928, issue of the *Journal*.

In the following lists the most precocious varieties are indicated by the letter "P," and ripen ten to fifteen days before the Golden Chasselas, which ripens at the end of February or beginning of March in the Auckland, Hawke's Bay, and Nelson Districts; the varieties marked "1" ripen at the same time as the Golden Chasselas; "2" indicates ripening on 15th March; "3" on 25th March; and "4" on 10th April or later. The varieties ripening in the third and fourth periods, judging from their known habits in Europe, will ripen only under favourable outdoor conditions in the warmer parts of New Zealand or under glass. The exact time of ripening naturally varies with the more or less favourable climatic and local conditions.

Varieties from France.

(Nomenclature in accordance with catalogue of Messrs E. Salomon et Fils, Vine-nurserymen, Thomery, France.)

Variety.	Colour.	Ripening Period.	Remarks.
Alicante Bouschet ..	Black	2	Wine. Vigorous grower, exceptionally fruitful; special pruning necessary. Extensively grown in California for home-made wine. Wine very dark in colour.
Bicane	White	2	Table. Magnificent bunches, with large berries. Subject to irregular setting on own roots; can be improved by grafting. Very productive
Blanc de Calabre ..	White	3	Table. Ornamental; fruitful; good quality; slight Muscat flavour.
Boudales	Black	2	Table. Greatly appreciated as a market grape in southern France.
Buckland's Sweetwater ..	White	2	Table. Handsome bunches; berries have a pleasant Sweetwater flavour. Thrives both outdoor and under glass.
Chasselas Vibert ..	White	1	Table. A very good Chasselas, ripening ten days before Golden Chasselas.
Dattier de Beyrouth ..	White	3	Table. Superb variety de luxe; large berries and very large bunches; flesh firm; flavour agreeable. Under glass.
Fernand Rose	Rose	P-1	Table and wine. Heavy producer. Resistant to disease.
Firnrlesling Blanc ..	White	P-1	Wine. Very fine bouquet and sherry flavour. Resistant to disease.
Foster's Seedling ..	White	2	Table and wine. One of the best to grow, both under glass and outdoor. Must grades 11-12 Baumé.
Lang's Frühtraube ..	Black	P-1	Table and wine. Recommended for the cooler districts.

VARIETIES FROM FRANCE—*continued*.

Variety.	Colour.	Ripening Period.	Remarks
Madeleine Noire ..	Black	P	Table. Very early.
Malakoff Isjum ..	Black	3	Table. Decorative, sweet, and agreeable flavour. Carries well. Resistant to disease. Requires long pruning.
Maraville de Malaga ..	Red ..	3	Table. Magnificent bunches of red grapes; very fine effect. Flesh firm; agreeable flavour.
Margilhen ..	Black	1	Wine. Very fruitful. Fairly resistant to disease. Good ordinary wine.
Melascone Nera ..	Black	1-2	Wine. A Pinot recommended for its fertility and superior quality of wine.
Meslier Rose ..	Rose	1	Wine. A high-class white wine. Profits by generous pruning.
Muscat Caillaba ..	Black	1 2	Table and wine. Fruitful; medium-sized berry. Slight Muscat flavour.
Muscat de Frontignan ..	White	2	Table and wine. Fruitful. Celebrated Muscat wines of Frontignan in south of France, and of Asti in north Italy made from this variety. Strong Muscat flavour.
Muscat Rouge de Madère	Red ..	1 2	Table and wine. Vigorous and fruitful. Excellent Muscat flavour. Exquisite Muscat wines of Roquevaire produced from this grape.
Pinot Blanc de Chardonnay.	White	1-2	Wine. The well-known Chablis. Very fruitful when allowed plenty of wood.
Plant Durif ..	Black	1	Wine. Very fruitful; good ordinary wine. Vine resists downy mildew.
Rosaki ..	White	3	Table. Vigorous and fairly fertile. Large loose bunch of very big berries, golden when ripe.
Sicilien ..	White	1	Table. Vigorous and fertile. Large bunches and berries. Fairly resistant. An interesting variety; recommended for local marketing.
Superbe de Candole ..	Rose	2	Table. Vigorous; very fruitful; large loose bunches, with very large berries. Prefers mica-chist and light soils.
Traminer Rose ..	Rose	1	Table and wine. Exquisite eating; high in sugar content. In great demand as a wine grape in Alsace.
Vigne de Michel ..	White	3	Table. Very vigorous and fertile. Very large bunches and berries. Keeps well.

Hybrid Direct Producers.

Baco 12-12 ..	White	1-2	Table and wine.
Baco 22A ..	White	2-3	Table and wine.
Bertille Seyve 450 ..	White	1	Wine.
Bertille Seyve 822 ..	Black	2	Wine.
Conderc 299-35 ..	White	1	Table and wine.
Malègue 2049-3 ..	Black	1	Table and wine.
Malègue Messidor 1995-4	White	1-2	Table and wine.
Siebel 2653 ..	White	1	Table and wine.
Siebel 4121 ..	Black	1-2	Wine.
Siebel 4615 ..	White	P	Table and wine.
Siebel 4633 ..	White	2	Wine.
Siebel 4657 ..	White	2	Table and wine.
Siebel 4762 ..	White	1	Wine.
Siebel 4995 ..	White	1	Table and wine.
Siebel 5163 ..	Black	1	Wine.
Siebel 5213 ..	White	1	Wine.

VARIETIES FROM FRANCE—*continued.*

Variety.	Colour.	Ripening Period.	Remarks.
Siebel 5386	White	I	Wine.
Siebel 5408	White	1-2	Wine.
Siebel 5437	White	I	Table and wine
Siebel 5586	Black	I	Wine.
Siebel 5813	Black	2-3	Wine.
Siebel 5860	White	1 2	Table.
Siebel 5912	Black	1-2	Wine.
Siebel 6168	White	1-2	Table and Wine.
Siebel 6905	Black	I	Wine.
Siebel 6906	Black	I	Wine.
Baco 7 3	White	I	Table.

NOTE.—In view of the conflicting opinions published in Europe on the habits and qualities of direct producers, it is deemed advisable to reserve a more complete description of the above until they have been tried out locally.

Collection of Varieties presented by the Italian Government.

Variety.	Colour.	Ripening Period.	Remarks.
Aleatico	Black	1 2	Table and wine Sweet, refined Muscat flavour. Aromatic wine of special type.
Balafant	White	2-3	Table Large bunches of oval grapes; Muscat flavour
Zibibbo d'Arquata del Tronto	White	1 2	Table. Large oval berries. An early Muscat
Luhatica Nera ..	Black	2	Table Medium bunches of sweet, medium, oval berries.
Luhatica Pavese ..	White	1 ^p	Table Large bunches of big, firm, sweet, berries. Very fruitful with generous long pruning. Suitable for pergolas. Extensively grown in north Italy.
Malvasia Fuhrman ..	White	1	Table and wine. Aromatic flavour. Rich wine.
Moscato Bianco Precocissimo	White	1 ^p	Table. Earliest white Muscat. Large perfumed berries.
Moscato Bianco ..	White	2	Table and wine. Also known as "Moscato Bianco Commune." Is grown extensively for winemaking in north Italy and southern France. Known in France as Muscat of Frontignan (see above). One of best Muscats for table and wine.
Moscato di Terracina ..	White	2-3	Table. Very fine bunches of big grapes; fine flavour. Grown very extensively for the Roman markets, where it is preferred to all other varieties. Suitable for the warmer parts of New Zealand. 420A is recommended as a stock in phylloxera areas. Worth trying under glass.
Moscato Nero	Black	1-2	Table and wine. Excellent for both purposes. Medium bunches of medium berries. Gives best results with long pruning. Much used for wines, both still and sparkling.
Regina	White	2-3	Table. Professor Prosperi, one of Italy's leading viticulturists, describes this grape as probably the best table variety, as it unites all the desirable qualities of a good table grape.

COLLECTION PRESENTED BY THE ITALIAN GOVERNMENT—*continued*.

Variety.	Colour.	Ripening Period.	Remarks.
Sciamblese	White	3	Table. Heavy producer of very large open bunches of big berries. Skin rather thin. Short pruning.
Schiradzouli	White	3	Table. Large bunches and oblong grapes; handsome, and good eating; keeps well
Greco	White	2	Table and wine. Vigorous and fruitful; large bunches and berries; excellent flavour.
Barbera	Black	2-3	Wine. Vigorous heavy bearer. Does well on most soils; prefers clay slopes facing the sun. Richly coloured wine. Must, 12-14 Baumé. Produces famous Asti and Mouferrat wines.
Fresia	Black	2	Wine. Fruitful, resistant. Must dark red, 10-11 Baumé. Wine somewhat like Burgundy. Makes good blend with Barbera.
Sangiovese	Black	2-3	Wine. Fruitful. Rich must. Excellent wine of good keeping-qualities. Forms base of Chianti wines.
Grignolino	Black	2	Wine of a very fair quality; matures early. Makes a good blend with Barbera, of which it hastens maturity. Vine prefers dry climate, sunny aspect, and poor soils.
Nebbiolo	Black	2	Wine. Aristocrat of Italian wine varieties; produces finest table wines of Italy, known as Nebbiolo, Barolo, Gattinara, Sassella, &c., according to districts produced in Must, 13-14 Baumé. Suitable for dry calcareous hillsides of Hawke's Bay, and other similar sites in drier regions of New Zealand.
Bonarda	Black	2	Wine. Vigorous vine, fairly fruitful. Average must, 12 Baumé. Produces a fine sweet or dry wine according to treatment. Blends well with either the Barbera, Fresia, or Grignolino.
Corniola di Milazzo ..	White	2	Table. Fine bunches of long oval berries. Keeps and carries well. Vine fairly resistant to fungi.
Dorona di Venezia ..	White	1-2	Table. Vine robust and productive. A Venetian commercial variety. Long bunches of round fairly big berries. Sweetwater type.
Garganega	White	2-3	Table and wine. Long bunches of medium berries. Flesh sweet, perfumed, and slightly acid.
Moscato d'Amburgo ..	Black	2	Table and wine. The well-known Muscat Hambro. Exquisite flavour. Poor setter on own roots; sets well on 34E and some other stocks. Blended with Aleatico makes a high-class Muscat wine.

Resistant Stock.

Berlandieri × Riparia 34 Ecole	One of best stocks on which to graft table varieties. Use spreading also in vine vineyards, both in France and Italy. Like 420A, it does well on clay soils.
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Varieties received in exchange from Department of Agriculture, Victoria.

Variety.	Colour	Ripening Period.	Remarks.
Ferdinand de Lesseps ..	White	2	Table. Franco-American hybrid. Small bunches and berries, but delicious flavour and aroma.
Cabernet Sanzev ..	Black	2	Wine. A heavy-bearing Cabernet.
Palomino ..	White	2	Wine. One of the sherry grapes; a Sweetwater type.
<i>Resistant Stocks.</i>			
Rupestris x Cordifolia 107-11	..	..	} Two very promising stocks.
Cordifolia x Riparia 125-1	..	..

NOXIOUS WEEDS CONTROL.

IN his annual report for 1928-29 the Director-General of Agriculture (Dr. C. J. Reakes) makes the following remarks on the subject of noxious weeds control—

"The officers responsible for the carrying-out of noxious-weeds inspection have had a hard time, especially in those districts where ragwort is prevalent. They do their best, and the aggregate result of their efforts doubtless represents the exercise of a considerable amount of control. But, with ragwort and black-berry especially, a full enforcement of the Act would in many cases mean asking settlers to undertake a volume of work entirely beyond the capacity of their financial resources

"From time to time the question is raised of forming local Noxious Weeds Boards to take over the administration of the Act. This suggestion possesses a good deal of merit, in that, if adopted, local knowledge and local effort would be applied to local conditions. If given effect to it would undoubtedly mean that the Government would have to pay a considerable subsidy, though as an offset its own expenditure upon inspection would largely disappear and be limited to some overseeing responsibilities. At the present time County Councils possess powers enabling them to deal with noxious weeds (and in a few cases, by arrangement with the Department, they are co-operating in noxious weeds control). Hence a County Council could undertake the duties which the advocates of Noxious Weeds Boards consider should be carried out by the Boards.

"The control of noxious weeds constitutes a difficult and sometimes unpleasant responsibility, and consequently the undertaking of it can hardly be expected at first sight to appeal favourably to established county authorities, notwithstanding the fact that, having regard to the value of local effort in this direction, it would be a valuable forward step. Failing the establishment of localized control, some system of co-operation between the Department and County Councils, or, alternatively, local Noxious Weeds Boards, would be of distinct advantage, if not involving too great expenditure.

"All this may appear to convey the idea that the Department is desirous of getting others to relieve it of an arduous and difficult responsibility, but I trust it will be realized that the expression of these views is actuated only by the genuine desire to endeavour to find the most effective and practicable method of dealing with noxious weeds to the best advantage. As the success of Rabbit Boards has shown, organized local effort is very valuable in work of this kind."

Cider-making.—The total quantity of cider manufactured in New Zealand last season was approximately 50,000 gallons, representing a value of £12,500. The making of good-quality cider is a profitable means of utilizing large quantities of otherwise unsaleable fruit.

SEASONAL NOTES.

THE FARM.

PASTURES IN NOVEMBER.

ON many farms the pastures in November are characterized by a conspicuous accumulation of surplus growth. In many instances, unless ensilage is produced, it is difficult, if not impossible, to avoid that rank growth which is a natural consequence of the surplus unused feed. The rank growth is both wasteful and harmful--wasteful because its occurrence means that the pasture-growth is passing to a less desirable, less valuable condition; harmful because the rank growth tends to open up the pastures on account of the shading, resultant weakening, and possible destruction of the valuable "bottom" pasture species, such as white clover, crested dogtail, and *Poa trivialis*. Further, pastures cut for ensilage in November produce much more fresh leafy feed during the remainder of the season than similar pastures cut for hay at about Christmas or New Year, or than pastures which become rank and which are not cut at all.

Ensilage-making should much more frequently be looked to as a means towards proper pasture management, and this particularly if top-dressing has been carried out. There has been a marked recent increase in the amount of fertilizer applied to grassland; in some important districts the amount so utilized has doubled in the past two seasons. It can be taken as an axiom that the best accompaniment of pasture top-dressing is close grazing. Ensilage-production can be made to assist greatly in the carrying-out of close grazing of pastures, particularly during the critical November-December period. Extra fields closed for ensilage remove the danger introduced by the oversupply of feed which is apt to occur if an attempt is made to handle the growth by the same number of stock as was carried earlier in the season.

Intensive grazing and "topping" of pastures were discussed last month in these notes as other means of keeping the pastures short in growth. It is necessary to bear in mind that there is a vital difference between proper rotational or intensive grazing and merely shifting the stock about. Many farmers frequently shift their stock from one paddock to another, and so in one sense they rotationally graze, but they do not practise rotational grazing as described last month, and of course they do not obtain the benefits which follow from that system.

Essential features of proper rotational grazing are (1) relatively heavy stocking for somewhat short periods and thorough eating down of the growth; (2) complete spelling of the pasture, following the heavy grazing, to allow of the development of a clean, fresh growth; (3) repetition of the heavy stocking and thorough eating-down before the growth has become long enough to bring about either waste or injury to the pasture. For instance, a field would be stocked with eight to sixteen cows to the acre until if kept longer on the field the stock would suffer; then the field would be rested until it again provides about two day's feed for stock carried at a similar rate.

Harrowing of pastures to bring about proper distribution of stock-droppings is a pasture-management measure the full value of which seems to be still but poorly appreciated. The consequence is that it is much more generally neglected than the benefits which it can confer warrant. It is essential, if full benefits are to result, to break up and distribute droppings before they have remained undisturbed for any considerable length of time. The longer they remain undisturbed the more difficult

it becomes eventually to distribute them properly. Further, as they remain undisturbed, their soluble fertilizing ingredients are washed out into a relatively small area of soil, and this results in the development of undesirable patches of rank growth throughout the field, even when harrowing is done later.

UTILIZATION OF ESTABLISHED LUCERNE.

One of the commonest errors made in the utilization of established lucerne is to wait unduly late before mowing the first cut of the season. This undue delay frequently owes its origin to the fact that favourable haymaking weather is not experienced when the first cut is at a proper stage to be mown with the most advantage, and the pastures at that stage are making such good growth that there is nothing to be gained by cutting the growth from the lucerne-field and feeding it out in a green state to stock. The best practice, provided the lucerne-field will yield a sufficient amount of material for the purpose, is to make the first cut of the season from the lucerne-field into ensilage. In this way excellent ensilage may be usually obtained, since the first cut generally contains a considerable proportion of plants other than lucerne, such as rye-grass and annual meadow-grass, and these, mixed with the lucerne, produce high-quality ensilage.

The necessity for removing the first cut at a date earlier than that at which it is often done arises from the fact that the invading plants, which so commonly are prominent in the first growth of the season—be they worthless species or relatively useful ones such as rye-grass—are definitely doing harm to the lucerne plants present by shutting off from them a certain amount of light, and the longer these invading plants remain unmown the more are the lucerne-plants weakened. Once the first growth of the season has been mown on the lucerne-field, the invading plants are usually unable, during that season, again to shut out the light from the lucerne plants. This is because with warmer weather the lucerne gains the ascendancy in respect to rapidity of growth, whereas during winter and early spring invading plants make more rapid growth than the lucerne does at that period, and so are able to win against the lucerne in the struggle for light.

A minimum amount of about 20 tons of green material is necessary for satisfactory making of ensilage, and the first cut of the season from a thriving lucerne-field should yield from 7 to 9 tons of green material to the acre. If the lucerne-field will not yield sufficient green material for economical saving into ensilage, that which the lucerne-field yields can often be admirably supplemented with surplus growth from the pastures, which, moreover, will benefit from the early mowing.

SOIL-INOCULATION FOR LUCERNE.

The lucerne crop, in a most interesting manner, operates in conjunction with lowly soil organisms in such a way that both the lucerne and the organisms benefit. It has become the practice—and it is a sound practice—to supply the necessary organisms to the soil at or about the time of sowing lucerne. This practice is known as soil-inoculation. The farmer cannot readily find out whether the soil organism is present in his soil or not, and whether, therefore, he should inoculate or not. He can inoculate without much cost, however, and will be well advised to do so and so be on the safe side.

One of the most ready means of carrying out the inoculation is to procure from the Plant Research Station, Palmerston North, some suitable cultures of the necessary organism, which are supplied free of charge, and to follow carefully the instructions which are sent in regard to the use of the cultures.

One important point recently established by investigations carried out by Mr. W. Reid, of the Plant Research Station, is that the use of superphosphate at the time when soil-inoculation for lucerne is being carried out seriously hinders the establishment of the valuable co-operation between the lucerne and the organisms which function with it. Hence the use of superphosphate should be dropped at that time. Fortunately, at that stage basic superphosphate or basic slag may be used in place of superphosphate without danger of any injury to the valuable soil organisms. It is not to be inferred from the above facts that superphosphate should not be used with an established crop of lucerne; extended field practice has shown that superphosphate is often an excellent dressing for established lucerne.

MANGELS.

One of the most valuable special forage crops is the mangel, which, judging by the area devoted to it in recent years, is becoming more neglected rather than more appreciated. Features which give the mangel its great value are: (1) Its remarkably high yield when given good treatment, yields of 70 to 100 tons and over to the acre have occurred freely over a range of years on greatly differing farms situated over a wide range of country; no other crop will so consistently give such high production: (2) its freedom from serious attack of pests or disease: (3) its ability to withstand well a dry period during the growing season: (4) its comparatively good feeding-value per ton and its good keeping-qualities.

The fact that despite these merits the area devoted to the mangel has declined is due to some extent to this crop's special need for good treatment. Success with mangels calls not only for thorough cultivation but also for liberal use of fertilizers, to which no farm crop, with the possible exception of the potato, responds better. A good fertilizer dressing for mangels would result from applying the following mixture per acre: 2 to 4 cwt. superphosphate, 2 to 4 cwt. blood-and-bone, 1 cwt. 30-per-cent. potash or 2 cwt. kainit. Possibly 1 cwt. of sulphate of ammonia and 3 to 5 cwt. of salt could at times be added with advantage.

The salt and kainit should be broadcast and harrowed in a week or so before the seed is sown. If the heavier amount of superphosphate is used it should be so incorporated with the soil as not to come in close contact with the seedlings as soon as they have developed, otherwise injury to them will result. Mangels are sometimes sown in October, but in general there is nothing to be gained by specially early sowing, and particularly if cold wet conditions occur the earlier-sown crops may be poorer in yield than the later-sown ones. Quick germination, which the warmer later conditions favour, is of considerable importance with the mangel, especially when weeds are likely to make themselves troublesome.

To induce quick germination the seed may be soaked for twenty-four hours in water before sowing. It may be sown immediately after soaking or left for a few days, when it will germinate quickly—either way proves quite a good practice. The seed should be sown at the rate of 5 lb. to 6 lb. an acre in drills 21 in. to 28 in. apart, to allow freely of intertillage during the growing period. Of varieties it is significant that Prizewinner has always held a very prominent place in farmers' competitions when the yields came to be weighed. Other good varieties are Orange Globe, Red Intermediate, Long Red, and Jersey Queen.

CHOU MOELLIER.

Chou moellier is here mentioned mainly because it has received more attention during recent years than formerly. It is a crop which calls for high fertility—it demands a soil of the type which would suit cabbage.

If it is desired to grow chou moellier on inferior soils their fertility should be improved, and farmyard manure is a fine dressing for this purpose. If sown in October or November on fertile soils chou moellier is well adapted to provide feed in late summer. A suitable seeding is $1\frac{1}{2}$ lb. to 2 lb. of seed to the acre sown broadcast, or $\frac{1}{2}$ lb. to $\frac{3}{4}$ lb. in drills 2 ft. to 3 ft. apart. It responds well to liberal use of fertilizers, such as a mixture of super and blood-and-bone in equal parts; 3 to 4 cwt. of this mixture may usually be applied with profit, and such a dressing may often advantageously be supplemented with 1 cwt. of sulphate of ammonia. Chou moellier is less subject to attacks of disease than other members of the cabbage family. It is distinctly suitable for cows, pigs, and poultry. Quite a number of successful sheep-farmers favour it for carrying sheep through the winter. It will not fatten lambs as well as rape.

IMPLEMENTS.

All implements and equipment that will be in use during the saving of hay and ensilage should be made ready for immediate use well ahead of the time when they are likely to be put in use. Time lost through faulty implements, especially in connection with the saving of hay, at times proves very expensive.

—R. P. Connell, M.A., *Fields Division, Palmerston North.*

FISH-TAINT IN PIG CARCASSES: A WARNING TO FEEDERS.

The pig is too often considered as an animal only useful for consuming all and sundry by-products. In this connection it is well known that the diet has a considerable bearing on the nature and quality of the meat of the carcass. The nature of the fat is a highly important factor, and is an indication of the quality of the carcass as a whole. The fat should be firm, white, and even, but that it is readily influenced by the diet may be instanced by the effect of an excess of maize in the ration. Maize is a badly balanced food, being very rich in starch and poor in protein, and when given in a large proportion (say, over 60 per cent) it produces a carcass with heavy oily fat unsuitable for pork or bacon.

In this country a large number of pigs are fed on slops of some kind, which produce a carcass of lower quality than the grain-feeding. These slop-fed animals require the addition of some meal to their ration to assist the growth and fattening process. In a number of cases of late fish-meals or proprietary preparations containing whale-oil have been used instead of, or in addition to, purely cereal meals, and it is the indiscriminate use of these fishy foods that has largely contributed to the recently reported fish-taint in New Zealand pig carcasses. Pure white fish-meal of known quality and standard is an excellent food, but is not always readily obtainable with a guaranteed analysis, which latter is essential for maintaining a balanced ration. The tendency of these meals is to contain an undue proportion of the offal from fish-shops, which is very rich in the heavy "liver" oil giving the taint.

The two important constituents that must not be in excess in fish-meal are salt and oil; an average of 2 per cent. and 3 per cent. are a suitable proportion, but never more than, say, 4 per cent. or 5 per cent. It must be remembered that, bulk for bulk, fish-meal weighs practically twice as much as any cereal meal, and a farmer may unknowingly be feeding his pigs on, say, 20 per cent. of fish-meal instead of 10 per cent., with the result that the stoppage of the meal a few weeks before killing does not have the desired effect.

Farmers are therefore recommended to discontinue the use of these foods for three months before slaughter, carrying out the change gradually so as

not to check the fattening-process. The feeding of grains, where obtainable, is recommended both to increase the general quality of the flesh and to overcome the taint. Experiments are now being carried out by the Department of Agriculture with a view to determine up to what period before killing fish-oils, &c., can safely be fed without tainting the carcass, and the results will be made known to farmers in due course.

—Live-stock Division.

THE ORCHARD.

CARE OF THE TREES.

YOUNG trees planted during the dormant season and last year's grafts which have been pruned will require an occasional inspection for the purpose of suppressing badly placed or unnecessary shoots. The future symmetry of the head depends upon setting a good foundation, and if the growth is limited to only those shoots which are well placed, future prunings will be simplified and growth stimulated in the desired direction. It frequently happens that two shoots will arise from a common base, in which case one should be removed to prevent the formation of a fork with an acute angle which will be liable to split when supporting a crop of fruit. Young grafts should be watched for the first appearance of *Captioptes obliqua*, the greyish beetle which feeds on the young growth, showing a preference for the shoots coming from the graft. Arsenate of lead does not appear to be a satisfactory control, and hand picking once or twice daily is necessary in districts where this pest is troublesome.

SPRAYING.

Apples and pears must be kept under observation to ensure making the first arsenate-of-lead spray for codlin-moth control at the correct stage of development. Each variety must receive attention when approximately three-quarters of the petals have fallen. To strike an average over the orchard may result in catching some trees at the right time, others not sufficiently advanced may be set badly, due to injury to the pollen, and the early-flowering ones may have advanced to the stage where the calyx lobes have closed in and covered any eggs which may have been laid.

Black-spot may be expected at any time, and close adherence to the spray programme during periods of moist, humid atmospheric conditions is essential. Black aphid will be active on stone-fruit, and should receive an application of Black Leaf 40. These insects increase very rapidly, and further applications at short intervals may be required. Wood-production for next season's crop can be seriously retarded by them.

Brown-rot control will bulk largely in the spray programme from now on. As an adjunct to spraying, the fruit should be thinned sufficiently to allow each one to reach maturity without touching its neighbour. Where fruits are in contact, moisture sufficient for the germination of Brown-rot spores is held for a longer period than where the fruit is exposed, and control is rendered more difficult. Spraying with sulphur paste or dry-mix should be done about three weeks after fruit has set, and then at three-weekly intervals until shortly before picking, but washing of the spray off the trees by heavy rains may necessitate more frequent applications.

In spraying it is not sufficient to apply the spray until the tree drips. That can be done by standing in one position, but to wet every portion it is necessary to keep moving round the tree, and if every portion does not receive its share good results cannot be expected.

FIREBLIGHT.

Frequent inspection of apple, pear, quince, and hawthorn trees should be made for any appearance of fireblight, and immediate action taken to

minimize the spread. The brown, dried appearance due to pear-slug on hawthorn and pear-leaves frequently leads those unacquainted with the appearance of fireblight to suspect the presence of that disease, but any suspected cases should be immediately reported to the district Orchard Instructor for investigation. The sudden death of the tips of young shoots, to which the foliage adheres, assuming a brownish colour similar to the result of scorching, will call for closer examination, and the contrast between the healthy portion of the tree and the diseased area will facilitate detection. Cutting out and burning all infected portions should be done immediately the disease appears.

SPRING PLOUGHING AND MANURING.

If spring ploughing has been delayed it should be completed at the earliest opportunity and the disking or harrowing proceeded with. Late ploughing in dry weather, by checking the root-action, will sometimes seriously interfere with setting or cause a heavy drop of young fruit.

Where nitrates are required they should be applied during the coming month, before the dry weather sets in and minimizes their efficiency.

Citrus-culture.

Cultivation should now be well advanced, and frequent light surface stirrings to keep weeds down and maintain a fine tilth will be all that is required.

When the main blossoming of lemons is finished, and the young fruit is showing, a 4-4-40 bordeaux spray for the control of verrucosis should be applied. This disease, if permitted, will infect the young leaves and thus carry over through the season, infecting young fruits and producing the rough scabbed condition which greatly reduces their value.

All ripening fruit should be picked as soon as ready, so as to allow full development of the new season's crop. If allowed to remain and fully ripen on the tree this fruit becomes coarse, thick in the skin, with a very low juice content, and consequently of low commercial value.

Any sickly trees should be closely examined and the trouble diagnosed. The most frequent causes of debility are red scale and collar-rot. Scale is readily detected, and an oil spray followed by manuring with nitrate of soda will stimulate growth. Collar-rot will entail a more thorough examination. The soil should be removed from round the stem and the base of the main roots exposed. The disease causes the bark to rot, commencing at or below the ground-level, and if unchecked will ring-bark the tree and cause death. Deep planting and bad drainage are frequent causative agents, and very often the initial infection can be traced to injuries by spade or hoe during cultivation. The diseased bark should be completely removed, cutting back into healthy tissue, after which the wound and surrounding bark is painted with bordeaux paste or neat lime-sulphur. In large trees where a considerable area is involved it is advisable to plant one or two seedling oranges close to the trunk for inarching or grafting by approach to bridge the gap in the sap-conducting vessels. The practice of heaping lawn clippings and fowl-horse scrapings around the stems of lemon-trees is conducive to collar-rot attack, as is also permitting water to lodge round the stems.

Young borers will now be active, and can be located by their fresh castings. The most satisfactory method of control is to inject benzine into the holes and then plug them with soap.

Probably no fruit shows such wide variations from the most desirable types in habit of growth, quality, and productiveness as is found in the citrus family. It will be found that some trees are prone to producing coarse rank growth, a large proportion of cull fruit, too many thorns, or other

equally undesirable features. When these failings are definitely established it will be found advisable to head the tree back sufficiently to cause it to produce young shoots from the best-placed limbs. These can be worked over with buds taken from a tree of better type, and the old portions removed as the new growth increases. It is necessary to paint all large wounds as a protection against fungoids. In selecting buds it is advisable to choose fresh round wood, with well-developed eyes free from thorns, on a twig which has produced fruit. Strong vigorous shoots should be avoided. Budding may be done during October or early November, or deferred until the bark lifts freely in the autumn. If the work is done in the spring the shoots may be headed back to the bud by Christmas-time and good growth produced by the autumn, but the latter ones will stand over and be headed in the following spring.

—G. H. McIndoe, *Orchard Instructor, Auckland.*

POULTRY-KEEPING.

LATE HATCHING.

WITH the heavy cost of production at present facing the poultry-keeper it will only be in those exceptional cases in which specially favourable conditions are present that it will pay to hatch November chicks. Therefore, if more chicks are required there should be no delay about it, for the later the hatching the lower will be the productive capacity of the flock.

DUCKS FOR THE FARMER.

There is still ample time to hatch out the laying type of duck. The keeping of a small flock of ducks is a matter which should appeal particularly to farmers and small settlers, for it is on farms and small holdings where a good range is available that a maximum profit can be made from a flock of high-type layers. It may be said that ducks are heavy feeders, and with the present high cost of food will return a poor margin of profit over their keep. This may be true where the whole of the food they require has to be purchased. On the farm, however, it is entirely different, for where a free range is available, and particularly where there are creeks or the land is swampy, ducks will at most times of the year themselves find a great deal of the food they require.

Probably the two most popular breeds of duck in New Zealand at the present time are the Indian Runner and the Khaki Campbell. The latter can be regarded as a much better dual-purpose breed than the former. Both of these breeds are good foragers, and when given their liberty the worms, snails, and other forms of insect life, combined with green material picked up, make an ideal food for promoting egg-production.

Compared with fowls, the cost of accommodating ducks is much less. In most parts of New Zealand they do not need houses; a low wire-netting fence about 2 ft. high erected in a dry, well sheltered locality is all that is required. This is merely for the purpose of yarding the birds by night. Owing to the fact that ducks usually lay their eggs at that time, and drop them anywhere, the work of collecting would be a troublesome matter were the birds not enclosed, to say nothing of the eggs that are likely to be lost. If the birds are kept penned until about 10 a.m. few if any eggs will be laid later. Ducks are creatures of habit, and if given a good feed at a regular time in the evening they can generally be depended upon to come home, when they can be penned up for the night.

FEATHER-PULLING.

Several inquiries have reached me lately with regard to fowls losing their feathers. In some cases it is regarded as an unreasonable moult

setting in, and in others the owners of the birds are at a loss regarding the cause. It is, however, a matter of feather-pulling and nothing else. This is a bad habit, and is usually the result of confined quarters, insufficient exercise, and the presence of vermin, the latter in most cases being responsible. The particular class of parasite that causes this trouble makes its home about the roots of the feathers, and causes intense irritation of the skin. The fowl, in order to rid itself of the irritation caused by the insects, may pull out the feathers herself, but generally invites her mates to do so. There is practically no cure for this trouble, and the only way of fighting it is to prevent it, or, if possible, to remove the cause, for once the majority of the birds in a flock acquire the habit it is a difficult trouble to overcome.

It is commonly stated that an ample supply of animal food, frequent changes of diet, or adding flowers of sulphur or salt to the morning mash will have the desired result. I have seen all these tried, but without success. In fact, in the worst case of feather-pulling I ever saw the birds were given as much boiled meat as they could eat at all times. The only proper treatment of this deplorable habit is to remove the cause, and the first essential is to provide ample range. Where this is available feather-pulling is practically unknown. Constant warfare must be made on vermin by keeping houses clean and giving them a frequent spraying with a strong disinfectant. Good dust-baths must also be provided. While the best way of fighting vermin is to prevent them from making their appearance, this is sometimes more easily said than done, as even under the best of management they are apt to give a certain amount of trouble. This being so, the combination of preventive and curative methods may be found necessary if the flock is to be kept free from parasitic infestation.

The value of Black Leaf 40 (a by-product of tobacco) for freeing fowls of all kinds of insect pests is not by any means appreciated by poultry-keepers as much as it should be. From $2\frac{1}{2}$ lb. to 3 lb. of this preparation is sufficient to free one thousand birds of any lice that may be upon them. The material for this number can be effectively applied in about fifteen minutes, and the following is a good method of doing so. Make a small hole in two opposite corners of a small tin containing the material, and pass it along each perch, leaving a thin line of the liquid on the perch. Do this at dusk, just before the birds go to roost. Do not dilute the material with water, or it will not have the desired effect. For the treatment to be really effective it is important that all birds should go or be placed on the perches, and not allowed to roost in odd corners of the house. If there is much dust on the perches the liquid is apt to run off and be wasted, and to prevent this it is a good plan to first rub the perches over with a damp cloth. If this is done the liquid can be more easily applied to the centre of the perch, and the risk of wastage will be reduced to a minimum. This treatment is rapid in its effect, for if the birds are examined, say, twenty minutes after the perches have been so treated, practically every louse will be dead and will be found on the tips of the feathers. Birds that are in broody-coops, single pens, &c., may be freed from vermin by dipping a feather into the liquid and drawing it under both wings, or by putting a small amount between the breast-feathers. Black Leaf 40 is sold in liquid form, in various-sized tins, by vendors of orchard sprays and others.

It goes without saying that where feather-pulling is giving trouble, due to the presence of vermin, Black Leaf 40 will prove invaluable. Indeed, many instances have lately come under my notice of poultry plants where feather-pulling in the past had given endless trouble being absolutely cleaned up since the birds have been treated for lice with this nicotine preparation.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SWARMING.

By November, if the weather conditions are favourable, swarming should be in full swing throughout the Dominion. Therefore it is most important that the beekeeper should note the condition of his hives in ample time to decide which colonies are to be allowed to swarm. Excessive swarming is often accepted by beginners as a proof of prosperity, but this cannot be regarded by any means as an established fact. Only strong colonies headed by young vigorous queens should be allowed to swarm, and in many cases it will be found that these colonies show little inclination to do so. Where a colony of moderate dimensions persists in making preparations for swarming it should be requeened from better stock at the earliest opportunity.

When a strong colony swarms, the swarm should be hived at once into a clean box, in such a manner that the bees may pass in and out of the box easily, and be left there till towards evening. By that time a hive should be prepared containing frames fitted with full sheets of foundation, and, if necessary, a feeder, the hive being placed on its permanent stand. Late in the afternoon the hive-body should be raised from the bottom-board and a clean sack laid on the alighting-board and surrounding ground. The bees should be dumped from the box on to the sack, when they will crawl into the hive.

If honey is not coming in freely, or if bad weather supervenes, the swarm must be fed with syrup prepared from sugar and water, in the proportions of one to two, so that the bees may commence comb-building at once. Excellent combs are made from sugar-syrup, and within two or three days the bees should have drawn out several combs and the queen be busily engaged filling the cells with eggs. The bees in a swarm are prepared for comb-building, and will simply waste much wax if placed at once on drawn-out combs.

If the beekeeper has any reason to suspect the hive from which a swarm issues to be diseased, he should leave the swarm in the box into which he has hived it for at least three days, in order that the bees may use up the honey they will have brought with them when they left the parent hive.

After the swarm has issued the parent hive should be thoroughly examined, so that the queen-cells may be removed. Every cell except two of the best should be taken away. Where the hive contains particularly good stock, and the queen-cells are large and ripe, they may be carefully preserved and placed in nuclei for the purpose of queen-raising. Very often the best queens in the apiary are procured by this means. When the swarm has been placed in its permanent hive the frames should be carefully covered by good mats. Neglect of this precaution, even for two or three days, will often result in the bees building comb right into the roof, especially where gable roofs are used, thereby wasting much good material as well as making the hive difficult to open.

AFTER-SWARMS.

It often happens that in spite of all precautions strong colonies will throw an after-swarm within a few days of the issue of the prime swarm. Sometimes the prime swarm will be delayed by bad weather, in which case the bees may have kept the virgin queens in their cells until the laying-queen has left the hive, only to liberate them immediately after, and before the apiarist has time to examine for queen-cells. These queens, being small and quick-moving, are very difficult to detect, and will probably escape notice altogether. In this case the after-swarm may follow very

quickly after the prime swarm. Occasionally, too, a few queen-cells may be missed in cutting out. If they are built, as frequently happens, on the edge of the comb against the side of the frame they are very easily overlooked.

After a little observation an after-swarm can often be detected by its behaviour. A laying-queen is heavy with eggs, and will usually seek a resting-place without delay and without venturing too high from the ground. Sometimes, indeed, she falls to the earth, and the bees will be unable to find her and will return to the hive. However, she will usually alight in some convenient spot, and the bees will cluster round her with amazing rapidity. When the hives are scattered instead of being in regular rows, a beekeeper working in his apiary at a distance from a swarming hive may miss the whole operation of the issuing of a prime swarm unless the noise attracts his attention, so quickly, as a rule, do the bees settle with a laying-queen.

With one or more virgin queens in a swarm matters are usually different. The queens are small and light, and will often soar to a considerable height, choosing their own time about settling. If there are two or three queens in a swarm there will probably be as many divisions in the cluster, so that instead of forming one compact heart-shaped mass the swarm may hang for a considerable time in several peaks. Care should be taken to see that every section is shaken into the box.

A simple method of dealing with after-swarms is to place an excluder between two empty hive-bodies, the lower of which rests on the ground or a bottom-board. Shake the swarm on to the excluder, when the bees will go through the holes in the excluder, and the queens may easily be distinguished and removed. When the queens are gone the bees will return to their parent hive, and the queens may be utilized for replacing old and failing queens. There need never be any doubt as to the advisability of taking every queen from an after-swarm—there will inevitably be one queen left in the hive for the bees to return to.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

TOMATOES UNDER GLASS.

IN the cool greenhouse the tomato crop will now commence to ripen, and the house is nearly filled with tall plants growing in close-ranked files. Thus there is very little air left for circulation, and it quickly becomes overcharged with moisture from the transpiration of the relatively large mass of foliage. Under such conditions and with the rising temperatures at this season of the year the position becomes difficult for the tomato-plant, which loves a buoyant sunny climate. This method of crowding tall plants into large houses requires very careful manipulation to mature a big crop successfully. Houses that are allowed to attain a high temperature and humidity in the morning and are then thrown open to a cold draughty wind will suffer severely by being chilled. Others with insufficient ventilators at the ridge to allow the hot humid atmosphere to escape will also suffer from the unsuitable conditions, which are so conducive to the development of mould fungus.

Those who have charge of these houses will need to rise early in the morning during fine weather to open the ventilators before the temperature rises much over 70° F., and ample opportunity should be afforded in the roof of the building for thoroughly ventilating the house at this season if the crop is to be profitable. Prompt attention will also be needed when cold winds occur, as they do occasionally in some localities, to shut off the

cold draught that is then liable to blow through the house. Such attention as this will contribute a great deal to the steady swelling and ripening of the crop, which will then be of good colour, size, and flavour, and compare very favourably with the slow development that is experienced when the foliage is crippled with disease or the plants checked by chilling.

Such a closely planted crop under cover in a warm atmosphere requires a considerable amount of water. In some instances this is amply supplied naturally in the form of a high water-level in the subsoil, upon which the plants can draw; in many cases, and especially where the subsoil is inclined to be rather dry, artificial watering will have to be done. The water should then be applied generously during the evenings at necessary intervals. In such cases the requisite condition will best be maintained by applying now a surface mulch of strawy stable manure or its equivalent. This treatment will be facilitated, and the bottom bunch will colour quicker, if the lower leaves, which will now have become ragged and practically ceased to function, are removed and carried out and destroyed. They should be trimmed off to a height just above the bottom bunch.

THE OUTDOOR TOMATO CROP.

Preparation of the land for the outdoor crop has been somewhat difficult this season owing to the heavy rainfall in most districts, and especially is this the case in soils rather deficient in humus through the neglect of cover-crops for ploughing in. Where this has been done and suitable intervals of fine weather chosen for cultivation, the condition of the land is a pleasing contrast to that where the grower has been unable to give it the necessary treatment and observe the same care in choosing the time for ploughing and working the soil.

The necessary artificial manures having been applied, the plants should now be set out as soon as they are ready and the weather is suitable. Patchy unprofitable crops are often due to a mixed lot of plants being put out, in which case the result will naturally be similar. As far as possible good even plants that have been grown without a check should be planted, rejecting all that are blind, small, and untrue to type. Careful culling of the plants at this stage will go a long way in obtaining a successful crop. It is better to plant a smaller area in this manner, if necessary, and use the spare ground for another purpose. Set the plants deep and firm, and follow up with frequent light cultivation in fine weather to suppress the weeds and maintain the steady growth that is necessary to obtain strong healthy plants and early cropping.

SMALL FRUITS.

The Cape gooseberry is a popular fruit, and profitable on the right class of soil. Light rich soil in a warm locality will produce heavy crops with comparatively little risk or trouble. The plants may be set out now 3 ft. apart and 6 ft. between the rows.

The busy berry harvest will now be commencing with gooseberries and strawberries; following on come the raspberries, currants, and loganberries. These useful and delicious fruits should receive more attention from the grower as well as the consumer; with a wider distribution and a little timely advertising the consumption could doubtless be increased to a very great extent. Finer crops of this class are nowhere grown, and many of the packages in the markets demonstrate the fact in an admirable manner. Some growers, however, do not exercise the necessary care in selection and packing, and depreciate prices to the detriment of other shippers, checking consumption by disappointing the consuming public who buy. Trading and consumption would improve greatly if this were discontinued. The greatest care and good taste is necessary in presenting these goods; they must be dry and cool when picked and kept out of the

sun. Undersized and misshapen or damaged fruit or berries too ripe for travelling but suitable for preserving should not be mixed with dessert fruit. Pickers must be carefully instructed and supervised regarding this matter, or a few overripe or defective berries will seriously depreciate the appearance and value of a consignment. If this is done and if the fruit is packed in clean crates and promptly shipped there is room for a greater supply of these very attractive delicacies.

THE MARKET-GARDEN.

As in most other sections, at this time of the year weeding and cultivation to promote growth and free the crops from the competition of weeds is of first importance. If fine dry weather is chosen and weeds are not allowed to grow to any size the work is easy and large areas are quickly dealt with.

Among the half-hardy vegetable crops being planted now—cucumbers, marrows, pumpkins, and dwarf and runner beans—the beans might well receive more attention in the warmer districts. They are in demand in both a green and dried state, and they are rightly regarded as important articles of diet. For imported dry beans we spend over £8,000 per annum, in addition to freights and general transport charges; of this quantity the greater part could be grown in this country if more attention was given to the crop. Both kinds require a light, rich, well-sheltered soil, and should be sown much thinner than is the usual custom here; 6 in. between the plants and 2½ ft. between the rows for the dwarf beans is suitable spacing. Runner beans may be grown 3½ ft. between the rows if they are grown without staking.

The harvesting of asparagus and rhubarb should be brought to a close during the month of November, in order to enable the plants to recover and form strong crowns for another season. A further dressing of fertilizers and manures now will greatly assist them in doing this and greatly increase the following harvest.

Tobacco-culture.

If the tobacco-plants are well hardened off and properly set in a well-prepared field they will soon become established. Careful supervision should then be given to replacing blanks as soon as they occur, also by cultivation in fine weather to keep down weeds before they attain any size, and to break the surface crust after rain. A fortnight after planting, when the plants are well established, the remainder of the manures mentioned in the last month's notes should be applied. This is sometimes done by moulding the plants up with a hand-plough, distributing the fertilizers in the furrow made, and covering them immediately afterwards.

A good early even crop depends very much on the supervision and attention given now so that the plants make steady growth when the conditions are favourable. Without such care they receive a check which delays the growth and is only corrected with difficulty under weather conditions that are generally less favourable for the purpose.

—W. C. Hyde, *Horticulturist*, Wellington.

Chewings Fescue Seed.—The experiments commenced by the Seed-testing Station in 1928 in dusting Chewings fescue with Semesan to overcome loss in vitality in storage or transport overseas are being continued, six parcels having been sent to Washington and Cambridge during the year 1928–29. Tests made at those places and at the New Zealand Station have shown so far that the treatment has in no way checked losses in vitality.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JULY, AUGUST, AND SEPTEMBER, 1929.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat reqd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys	lb.		lb.	lb.
Wyndale Golden Girl	A. O. Brown, Kamo	1 290	240.5	365	9,091.0	503.44
Glenview Emerald	G. Bulte, Waiuku	2 56	246.1	335	7,202.8	435.42
Silverstream Sky	G. B. Hull, Silverstream	1 335	240.5	365	9,062.3	426.77
Waiwetu Fairy Rose	A. J. Miller, Uruti	1 341	240.5	302	8,258.0	421.69
Veletit Mistressful	A. J. Kidd, Waiuku	1 352	240.5	299	8,686.4	406.53
Bethune Nelda	A. S. W. Hazard, Waimate North	1 235	240.5	365	7,234.0	401.73
Brooklyn Gaiety	H. J. Lancaster, Palmerston North	1 334	240.5	285	7,089.4	383.83
Otterburn Ringlet	E. J. Mears, Hamilton	1 363	240.5	348	5,973.2	373.95
Mildred of Tamahere	F. S. Veale, Cambridge	1 285	240.5	356	6,516.4	372.36
Perfection's Golden Lady	Mrs A. Jagger, Papakura	1 348	240.5	308	6,642.1	364.62
Patchwork of Ivory	H. W. Le Bailly, Buckland	2 8	241.3	365	6,993.0	363.16
Mt Kowhai Avoca	R. J. Johnston, Runciman	1 360	240.5	351	5,475.4	345.61
Park Farm Tootsie	H. Garlick, Makomako	1 349	240.5	334	6,354.8	342.09
Homeside Mayflower	H. Rogers, Pukekohe	1 316	240.5	317	6,014.6	328.98
Jewel of Tamahere	F. S. Veale, Cambridge	1 302	240.5	311	5,408.6	326.15
Te Aute Tinsel's Eileen	Miss E. Busby, Tokomaru Bay	1 332	240.5	285	5,708.2	323.61
Te Rangi Duchess	W. Hazlewood, Northcote	1 331	240.5	365	6,260.4	312.28
Sunflower's Sun Queen	W. C. Mears, Ngarua	1 362	240.5	280	4,482.4	312.22
Sweet Music	T. E. Churches, Dargaville	1 336	240.5	331	5,571.7	304.74
Hilton Mermaid's Beauty	Mrs M. A. Wright, Tirau	2 43	244.8	275	5,008.7	286.73
Hilton Early Dawn	Mrs M. A. Wright, Tirau	2 50	245.5	287	4,894.5	286.31
Little Bush Viola's Peggy	J. J. Springgay, Gisborne	1 275	240.5	324	4,845.6	284.08
Restholme Wai	J. J. Goodwin, Morrinsville	1 341	240.5	295	5,344.5	281.82
Star Baby	H. W. Le Bailly, Buckland	1 307	240.5	365	5,593.1	263.60
Hilton Evening Star	Mrs M. A. Wright, Tirau	1 339	240.5	307	4,813.7	262.86
Conandale Flush Kitty	S. Dale, Fairlie	1 264	240.5	244	4,079.2	249.36
Senior Two-year-old.						
Silver Mahone	G. S. B. Morrison, Maungatapu	2 307	271.2	365	11,502.7	665.94
Kahuwera Lena	J. V. Mortensen, Piopio	2 290	269.5	365	9,640.8	507.58
Marshlands Sunflower	W. C. Mears, Ngarua	2 207	261.2	365	6,793.0	414.40
Rosedale Bronzewing	E. J. Adams, Puni	2 356	276.1	365	8,806.0	414.33
Falconite Maggie	G. Bulte, Waiuku	2 325	272.9	365	6,858.2	411.91
Kapuna Belle	J. Davies, Maxwelltown	2 328	273.3	314	6,833.7	383.66
Three-year-old.						
Sunbeam Radiant	R. W. Ferris, Masterton	3 166	293.6	365	11,512.3	596.87
Fairy Meadows Uranium	A. Hazelton, Waihou	3 330	310.0	365	9,526.1	544.27
Illston Daisy Bell	W. Robinson, Patumahoe	3 190	296.0	365	6,995.9	436.65
Fairy Meadows Beauty	A. Hazelton, Waihou	3 352	312.2	343	7,803.6	421.38
Mission's Princess	Mrs. M. A. Wright, Tirau	3 37	280.7	311	5,635.1	327.09

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—<i>continued</i>						
<i>Four-year-old.</i>		Yrs. dys.	lb.		lb.	lb
Illston Necklace ..	W. Robinson, Patumahoe ..	4 315	344·9	365	13,074·9	713·57
Marairohia Treasure..	W. Craig, Wauku ..	4 1	313·6	365	12,173·1	686·42
Beechlands Welcome Lady	A. Hazelton, Waihou ..	4 301	349·6	342	8,307·7	573·58
Linden Grove Silverlink	A. Hazelton, Waihou ..	4 265	340·0	365	6,918·8	483·25
Linden Grove Ayesha	A. Hazelton, Waihou ..	4 331	346·6	343	7,496·6	449·71
Rockview Fox's Beauty	W. H. Fitness, Rehia ..	4 356	349·1	308	7,703·4	440·30
<i>Mature</i>						
Cloverlea Snowdrop ..	W. A. Guy, Matapu ..	6 333	350·0	329	10,177·7	537·68
Kahuwera's Wee Lass	J. V. Mortensen, Piopio ..	8 255	350·0	365	10,269·8	506·20
Rockview Machree ..	W. H. Fitness, Rehia ..	5 307	350·0	365	10,257·3	492·64
Hillcrest's Nova Aquilae	H. S. Fleming, Clevedon ..	10 23	350·0	262	8,788·3	471·03
FRIESIANS.						
<i>Senior Two-year-old</i>						
Princess Lady Sylvia*	G. G. McRae, Waimate ..	2 286	269·1	365	12,632·3	374·14
Rosevale Rhoda Sylvia	W. Bryant, Otokia ..	2 229	263·4	308	9,515·1	287·37
<i>Senior Three-year-old.</i>						
Glen Iris Flower Girl†	Oakview Stud Farm, Auckland	3 305	307·5	336	14,803·6	539·44
<i>Senior Four-year-old.</i>						
Conemaugh Queen of Groteholm 2nd†	Oakview Stud Farm, Auckland	4 320	345·5	365	20,342·7	664·98
Abbecker Dutchland of Oakview†	Oakview Stud Farm, Auckland	4 225	336·0	365	16,766·2	572·23
Coldstream Bess Pietertje	E. W. Hancock and Son, Cardiff	4 362	349·7	283	11,304·7	467·96
MILKING SHORTHORNS.						
<i>Senior Two-year-old.</i>						
Vale Royal Daphne's Esau	Simms and Sons, Halswell..	2 321	272·6	365	11,319·3	496·04
<i>Junior Three-year-old.</i>						
Haurua Rose ..	A. L. Souter and Son, Wai-ranga	3 11	278·1	343	11,513·1	468·60
Matchless Edna May Cole	A. Park Horne, Buckland ..	3 44	281·4	284	9,423·5	398·23
<i>Mature.</i>						
Riverdale Grace III†	T. W. Wardlaw, Waimana	7 287	350·0	320	15,832·4	629·36
Bushcroft Fairy ..	H. Bond, Rangiotu ..	6 245	350·0	281	8,167·6	358·00
Second-class Certificates.						
Jerseys.						
<i>Mature.</i>						
Lyndon Daisy ..	R. J. Johnston, Runciman..	5 168	350·0	365	7,588·5	376·31

—Dairy Division.

NAURU AND OCEAN ISLANDS PHOSPHATE.

WORKING OPERATIONS AND SHIPMENTS

A REPORT by Mr. A. F. Ellis, C.M.G., New Zealand Commissioner, British Phosphate Commission, is embodied in the Annual Report of the Department of Agriculture for 1928-29, as under:—

"The ninth year of operations at Nauru and Ocean Islands under Government ownership terminated on 30th June, 1929, with the following results as regards phosphate shipments, compared with the previous year:—

			Eighth Year (1927-28)	Ninth Year (1928-29).
			Tons	Tons
Nauru..	..	..	310,990	342,770
Ocean..	..	..	190,925	233,820
			501,915	576,590

Bill-of-lading figures are taken in each case. An increase of 74,675 tons in quantity shipped will be noted, but falling short of our previous highest year (seventh year) by 16,750 tons. The latter year was one when particularly favourable conditions were experienced at the islands as regards weather, freedom from epidemics of sickness, labour difficulties, &c. The year just ended was what may be called a normal year, in that bad weather was experienced during the months when it is due, and the usual difficulties with shipping were encountered, though we were fortunate in not having any of the moorings carried away. When the fine season started rapid progress was made, and in May a record month's work was established—viz., Nauru, 44,500 tons; Ocean, 23,825 tons; total, 68,325 tons. The previous best month for Nauru was 41,931 tons, shipped in June, 1928.

As regards phosphate dried and stored ready for shipment, the ninth year constitutes a record, the figures for the last three years being as follows:—

			Seventh Year.	Eighth Year.	Ninth Year.
			Tons.	Tons.	Tons.
Nauru	..	..	326,095	332,230	346,764
Ocean	..	..	255,362	195,900	251,749
			582,057	528,130	598,513

In this connection it may be noted that under present conditions Ocean Island has no chance of an increased output owing to the phosphate-workings becoming more restricted each year through the difficulties in acquiring further lands. There is, however, reason to think the matter will be settled within a few months.

Importations into New Zealand of Nauru/Ocean phosphate, and phosphate from outside sources of supply for the last three years (by the Commission) are as follows:—

			Seventh Year.	Eighth Year.	Ninth Year.
			Tons.	Tons.	Tons.
Nauru/Ocean ..	..	..	139,535	136,718	138,053
Outside ..	..	..	10,415	42,946	29,288
			149,950	179,664	167,341

With regard to the percentage of Nauru/Ocean output coming to New Zealand, figures for the last three years are as follows: Seventh year, 21.95 per cent.; eighth year, 24.76 per cent.; ninth year, 24.66 per cent. We could have supplied a further cargo this year, but it was not convenient for the manufacturers to take it, owing to their storage-bins being practically full, and it was accordingly diverted to Australia."

The report concludes with a detailed table of shipments from Nauru and Ocean Islands for the year 1928-29. This shows that of the total of 576,590 tons of phosphate shipped, 434,395 tons (75.34 per cent.) went to Australia, and 142,195 tons (24.66 per cent.) to New Zealand.

WEATHER RECORDS : SEPTEMBER, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THIS year we have experienced the coldest September for a considerable time. All parts of the country report low average temperatures, and frosts were unusually numerous. Although cold, the month was a sunny one, there being numbers of beautifully fine days. Rainfall was, on the whole, below average. This was almost generally the case over the North Island, except about Wellington. In the South Island, both east and west coasts experienced a dry month, but Stewart Island, Southland, and much of the central portions of the Island had more than the normal fall. The low temperatures gave a distinct set-back to growing vegetation, and at date feed is rather short in most districts. Parts of the North Island escaped the severity of the storms and are in good condition.

The storms recorded during the month were in no case responsible for any very heavy rains except at a few isolated places. Snow, however, fell frequently, especially in the high country of the South Island. In the interior of Canterbury it has been one of the worst seasons on record for snow.

The tendency for storms to take on cyclonic form was again in evidence during the month. Subtropical waters to the north and north-east have been unusually frequently disturbed by storms of this type.

On the 1st a deep depression of the southern or westerly type was approaching the Dominion. A small cyclonic centre developed in its northern portion, and this crossed Canterbury on the afternoon of the 2nd. Heavy north-westerly gales blew in the Cook Strait region and over the South Island. The greatest severity was felt in Canterbury, and much damage was done to plantations in Ashburton County. Cold southerlies followed, gale force again being reached in places. Snowfalls were recorded in Canterbury and Otago.

Following a fine spell, another southern depression passed on the 8th. Northerly gales again blew in and south of Cook Strait. A tornado visited the Seddon district, in Marlborough. Some places reported thunderstorms.

A moderate cyclone crossed the North Tasman Sea during the period from the 10th to the 13th, passing between Norfolk Island and Cape Maria van Diemen on the last-mentioned date. Being so far north its effect was to produce fine rather than wet weather over New Zealand. When it was well to the eastward, however, on the 16th south-westerly gales were experienced.

Numbers of thunderstorms occurred on the 18th in association with the passage of a westerly depression which brought very low pressures and westerly gales to the far South. These storms were particularly severe in north Taranaki and at Murchison. Following this depression there was a severe cold snap with snow again in many parts of the South Island; some was seen also on the hills near Wellington. On the 21st a cyclone, coming from the north, appeared to the north-east of East Cape. South-easterly gales were experienced in parts of the North Island, and more snow fell in the South Island. The most severe period of the cold snap, from the 20th to the 22nd, became later the farther northward one proceeded. A very severe frost was felt in the Auckland and Thames districts on the 22nd, and great damage was done to potato and tomato plants.

A fine interval followed, but between the 24th and the 27th a series of cyclones moved from the Tasman Sea across the Dominion. Southerly gales set in from Cook Strait southwards on the 27th while the last centre

was crossing the Auckland Peninsula. A cold snap, reminiscent of that of a week previous, resulted. Snowfalls were again reported from the South Island, and hail in places. Thereafter mild and fair conditions developed.

RAINFALL FOR SEPTEMBER, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitia	4.05	10	1.15	4.75
2	Russell	2.64	14	0.92	4.36
3	Whangarei	2.86	20	0.53	4.91
4	Auckland	2.36	16	0.69	3.65
5	Hamilton	2.27	12	0.66	4.40
5A	Rotorua	2.20	9	0.59	5.16
6	Kawhia	3.00	15	0.86	1.32
7	New Plymouth	4.19	18	0.99	5.22
8	Riversdale, Inglewood	6.17	16	1.76	0.48
9	Whangaimomona	6.77	13	1.16	7.15
10	Eltham	3.93	14	0.91	3.91
11	Tairua	2.70	12	1.05	4.78
12	Tauranga	2.52	12	0.70	4.41
13	Maraekakaho Station, Opotiki	2.02	9	0.94	4.18
14	Gisborne	2.51	14	1.35	3.01
15	Taupo	1.84	7	0.61	3.82
16	Napier	1.01	9	0.68	2.19
17	Maraekakaho Station, Hastings	1.72	11	0.62	2.57
18	Taihape	2.33	16	0.59	3.44
19	Masterton	2.64	13	0.56	3.13
20	Patea .. ..	..	..	..	3.48
21	Wanganui	2.04	9	0.70	2.96
22	Foxton	1.95	9	0.72	2.43
23	Wellington (Karori Reservoir)	4.02	13	1.19	3.50
<i>South Island.</i>					
24	Westport	5.61	19	1.32	6.82
25	Greymouth	6.15	21	1.21	7.96
26	Hokitika	6.58	19	1.24	9.33
27	Ross	8.29	14	1.30	13.06
28	Arthur's Pass	22.58	19	9.36	15.50
29	Okuru	11.57	16	2.50	12.48
30	Collingwood .. ..	..	..	..	10.13
31	Nelson	3.78	5	1.20	3.75
32	Spring Creek	2.10	7	0.75	2.60
33	Tophouse	7.83	13	1.65	5.47
34	Hanmer Springs	5.39	14	1.39	4.10
35	Highfield, Waiau	2.72	10	1.20	3.12
36	Gore Bay	3.24	8	1.60	3.31
37	Christchurch	1.40	12	0.58	1.79
38	Timaru	0.64	9	0.26	2.07
39	Lambrook Station, Fairlie	2.10	11	0.64	2.21
40	Benmore Station, Clearburn	3.64	11	1.50	2.10
41	Oamaru	0.51	5	0.23	1.69
42	Queenstown	3.49	9	1.86	2.47
43	Clyde	1.16	6	0.58	1.06
44	Dunedin	1.99	15	0.63	2.74
45	Wendon	2.47	10	0.75	2.32
46	Gore	3.82	21	0.70	2.65
47	Invercargill	4.03	23	0.60	3.11
48	Puysegur Point	9.56	26	1.35	5.53
49	Half-moon Bay	9.83	22	1.45	4.54

—Edward Kidson, Director of Meteorological Services, Wellington, 7/10/29.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1929.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne	Wellington-West Coast	Marlborough-Nelson-Westland.	Canterbury-Kaikoura	Otago (including Southland).	Total in Dominion.
Stud rams (entered in flock-books)	995	1,355	3,685	724	3,083	2,952	12,794
Other rams ..	38,866	99,642	85,361	19,612	84,180	81,876	409,537
Wethers ..	404,497	666,048	742,779	228,730	565,951	681,130	3,280,135
Breeding-ewes ..	1,545,849	3,815,256	3,459,431	777,313	3,524,607	3,485,699	16,608,155
Dry ewes ..	50,361	240,784	186,252	43,878	177,849	177,574	882,668
Lambs ..	693,603	1,966,254	1,581,426	386,695	1,471,903	1,749,182	7,849,063
Totals, 1929 ..	2,734,171	6,795,339	6,058,934	1,456,952	5,827,573	6,178,413	29,051,382
Totals, 1928 ..	2,380,475	6,539,179	5,562,451	1,361,043	5,539,597	5,751,065	27,133,810

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1920-29.

Year.	Stud and Flock Rams.	Stud Breeding-ewes	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,980,186	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,973	23,081,439
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7,867	131,485	679,675	3,063,063	13,530,479	875,899	6,398,239	24,547,955
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	13,756,197	1,069,682	6,155,510	24,904,993
1927	388,274	199,219	8,644	144,807	741,934	3,074,974	14,632,511	823,947	6,377,450	25,649,016
1928	396,351	205,720	7,347	145,909	755,387	3,024,947	15,328,331	861,780	7,163,053	27,133,810
1929	422,331	219,802	7,203	156,526	805,862	3,289,135	16,388,353	875,495	7,692,537	29,051,382

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1929).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-books)—									
Merino ..	..	2	..	2	9,188	16,154	7,426	32,768	32,770
Lincoln ..	605	887	6,491	7,983	357	108	60	525	8,508
Romney ..	17,948	15,492	79,756	113,196	9,208	4,597	47,079	60,794	173,990
Border Leicester ..	782	..	448	1,230	338	12,777	10,276	22,791	24,021
English Leicester ..	924	358	26	1,308	1,597	19,843	638	22,078	23,386
Shropshire ..	369	..	381	750	4	2,074	1,203	3,281	4,031
Southdown ..	5,666	11,142	35,759	52,567	1,392	14,741	2,203	18,426	70,993
Corriedale ..	383	67	1,063	1,513	1,085	35,966	14,414	51,465	52,978
Ryeland ..	897	506	810	2,213	124	1,135	99	1,358	3,571
Other breeds ..	39	17	..	56	1,087	934	..	2,021	2,077
Totals ..	27,613	28,471	124,734	180,818	24,380	107,939	83,488	215,597	396,325
Sheep of distinctive breed, but not entered in flock-books—									
Merino ..	5,785	11,132	10,384	27,301	212,118	515,711	375,025	1,102,854	1,130,155
Lincoln ..	6,350	37,886	22,911	67,147	965	7,888	3,083	11,936	79,083
Romney ..	439,995	1,342,195	1,189,571	2,971,751	148,591	97,575	277,513	523,679	3,495,440
Border Leicester ..	3,979	3,083	908	7,970	1,955	30,680	20,786	53,421	61,391
English Leicester ..	3,333	1,154	1,968	6,455	11,755	57,042	3,971	73,068	80,123
Shropshire ..	2,585	645	1,541	4,771	2,527	6,994	3,242	12,763	17,534
Southdown ..	11,939	25,552	59,763	97,254	1,912	20,025	2,719	24,956	121,910
Corriedale ..	3,231	1,151	32,898	37,280	25,821	592,684	440,679	1,059,184	1,096,464
Half-bred ..	8,217	11,310	9,119	28,646	272,449	741,490	352,025	1,365,964	1,394,610
Ryeland ..	387	438	448	1,273	68	2,219	414	2,701	3,974
Other breeds ..	140	145	267	552	17	386	152	555	1,107
Totals ..	485,941	1,434,691	1,329,778	3,250,410	678,178	2,073,594	1,479,609	4,231,381	7,481,791
Crossbreeds and others not otherwise enumerated	2,220,617	5,332,177	4,604,422	12,157,216	754,394	3,646,340	4,615,316	9,016,050	21,173,266
Grand totals ..	2,734,171	6,795,339	6,058,934	15,588,444	1,456,952	5,827,573	6,178,413	13,462,938	29,051,382

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WOODEN TONGUE (ACTINOMYCOSIS) IN DAIRY STOCK.

“VOLCANIC,” Maungakaramaea :—

Will you kindly inform me whether any preventive measures can be taken against wooden tongue in dairy stock, and whether an affected animal may be permanently cured by dosing with iodide of potassium? Last season I had a second calver badly affected, and this year a two-year heifer a few days after coming to profit, both animals being reared on the farm. In both cases the front teeth also became loose. I have top-dressed the farm for the past eight years with basic slag and super alternately, lime has also been applied. Do you consider I am likely to have fresh cases occurring?

The Live-stock Division :—

One cannot do a great deal, but some preventive measures should be taken against this disease just as in any other disease of a similar nature. Whenever it is suspected that an animal is affected, it should be isolated at once until the true cause is known. Some of the earliest symptoms which may be observed by the average individual are that the saliva keeps dripping from the mouth and the food is chewed in an awkward manner, the animal is unthrifty in appearance, and possibly the tongue or gums are affected. Sometimes the cheek and face are swollen—it all depends on the nature of the tissues that are diseased. Sometimes the jawbone itself is affected. All fittings with which the animal has come in contact should be thoroughly disinfected with a strong solution of any reliable disinfectant in soap and hot water, and allowed to dry, and all walls, posts, &c., given a coating of limewash or some suitable tar preparation. If an affected animal has been noticed early, then treatment with iodide of potassium internally will in many cases effect a permanent cure. The dose is 1 to 2 drams given twice daily, and continued for about a fortnight as the circumstances and results warrant. Sometimes it is necessary to repeat the treatment if the symptoms recur. Should the jaw-bone itself be affected or the disease be well established, treatment is not warranted as a rule, as it is seldom that a complete cure is effected in such old-standing cases. Externally, if treatment can be given, the local application of strong tincture of iodine will help. Top-dressing the land with burnt lime must also materially assist. You will in all probability have cases cropping up from time to time no matter what trouble you go to, but you can always do everything possible to prevent other animals eating fodder that has been soiled by discharge or saliva.

ENSILAGE INQUIRIES.

“ENSILAGE,” Fairlie :—

Is Russian (black) barley a suitable crop for making ensilage? In making ensilage in a pit can it be left any time—say, when half full—and then completed?

The Fields Division :—

Black barley has been found quite suitable for making ensilage, and in your district is perhaps the best variety to grow for this purpose. The crop should not be allowed to mature, but should be cut and placed in the pit just before it starts to change colour. Control of temperature is most important in ensilage-making, and it would not do to fill your pit half full and leave it without it being weighted in some way. When the final layer is put in the temperature should be allowed to rise, as in the case of the earlier layers of green material, and then the pit should be covered so as to exclude the air. In some cases the weighting-material has been removed several weeks later when another crop was available for ensiling, and further material placed in the pit in layers of about 6 ft. deep each time; and when the pit was full weight was applied to exclude the air, and the pit covered so as to prevent rain entering.

ARSENICAL SPRAY FOR BLACKBERRY, ETC.

M. B., Awamarino :—

What proportion of arsenic and caustic soda should be mixed to make a potent weed-killer? If kerosene were added to the mixture to make leaves of plants unpalatable to stock that might gain access to the spot, would it interfere with the killing-strength of the mixture? It is intended to use the mixture on blackberry, honeysuckle, and lawyer, and as a pricking poison to crown of ragwort.

The Fields Division :—

A common and useful arsenical spray for blackberry is made as follows : Take 1 lb. of white arsenic, 2 lb. of washing-soda, and 1 gallon of water. Dissolve the soda in the water by boiling for fifteen to twenty minutes; add the arsenic and boil again until a clear solution is obtained. Use one part of this solution to twenty parts of water. White arsenic can also be dissolved in caustic soda, and a satisfactory formula for mixing is as follows. Take 1 lb. of white arsenic and $1\frac{1}{4}$ lb. of 98 per cent. fresh caustic soda. Mix the white arsenic and caustic soda together dry; then add a little water—sufficient to make a paste—stirring thoroughly with a stick, as soon as it commences to bubble run in a little more water, but not sufficient to stop the bubbling; when bubbling has ceased the full quantity of water may be added. Care must be taken to stir thoroughly and to keep away from the fumes, which are of a very poisonous nature. This type of spray is put up in 5-gallon drums by Murtons Ltd., Napier, and is sold at the rate of 8s. per gallon. It should be diluted from about 1 part in 90 to 1 part in 120. The spray does not entirely kill the blackberry-plants, but kills the tops and some of the crowns. The mixture is spread on the area with a knapsack sprayer, and the plants gradually wilt and dry up. Later the plant-roots send up fresh shoots, and these are left as long as possible and then the area is fired. Arsenic spray has a toxic effect on animals, and we do not think the mixing of kerosene with the spray would result in keeping the animals off the sprayed areas. Cattle are especially attracted to eat the sprayed vegetation because of the brackish sweet taste of the arsenic compound. It is inadvisable to allow stock near the sprayed area until the plants have been burnt down. After burning the vines there is no chance of poisoning.

AGRICULTURAL SHOWS, SEASON 1929 30.

THE following show-dates have been notified by agricultural and pastoral associations :—

Marlborough A. and P. Association : Blenheim, 23rd and 24th October, 1929.
 Wairarapa A. and P. Society : Carterton, 23rd and 24th October.
 Timaru A. and P. Association : Timaru, 30th and 31st October.
 Manawatu A. and P. Association : Palmerston North, 5th, 6th, and 7th November.
 Northern A. and P. Association : Rangiora, 8th November.
 Wanganui A. and P. Association : Wanganui, 13th and 14th November.
 Waikato A. and P. Association : Claudelands, 13th and 14th November.
 Canterbury A. and P. Association : Christchurch, 14th and 15th November.
 Egmont A. and P. Association : Hawera, 20th and 21st November.
 North Otago A. and P. Association : Oamaru, 21st and 22nd November.
 Nelson A. and P. Association : Richmond, 22nd and 23rd November.
 Otago A. and P. Society : Dunedin, 26th and 27th November.
 Stratford A. and P. Association : Stratford, 27th and 28th November.
 Southland A. and P. Association : **Royal Show**, Invercargill, 10th, 11th, and 12th December.
 Helensville A. and P. Association : Helensville, 29th January, 1930.
 King-country A. and P. Association : Te Kuiti, 6th February.
 Rodney Agricultural Society : Warkworth, 8th February.
 Dannevirke A. and P. Association : Dannevirke, 11th and 12th February.
 Tauranga A. and P. Association, Tauranga, 11th and 12th February.
 Masterton A. and P. Association : Solway, 18th and 19th February.
 Auckland A. and P. Association : Auckland, 27th February to 1st March.
 Taranaki Agricultural Society : New Plymouth, 5th and 6th March.

REGISTRATION OF STANDARD MARKS FOR STOCK.

THE following regulations under the Stock Act were gazetted on 3rd October :—

1. These regulations may be cited as " The Standard Marks Stock Regulations, 1929 "

2. Every application made under section 3 of the Stock Amendment Act, 1927, by an incorporated society for the registration of a brand or mark as a standard mark, to be used on stock for the purpose only of indicating that the said stock is, in the opinion of the society, of a standard of merit fixed by the society, or, as the case may be, is not of such a standard, or that the said stock has been tested under the auspices of the society, shall be in the form set out in the schedule hereto, and shall set out the particulars indicated in that form.

3. Every such application shall be made to the Director-General of Agriculture at Wellington.

4. Every such application shall be either under the common seal of the society or signed jointly by the president, chairman, or other presiding member of the society, and by the secretary, clerk, or other principal executive officer of the society, and in either case the personal certificate comprised in the said form of application shall be signed personally by such presiding member and executive officer.

5. The fee payable for the registration of any standard mark shall be £1 is., and such fee shall be forwarded with the application.

6. Unless the Director-General of Agriculture thinks fit to permit more than one standard mark to be included in one application, every application for registration of a standard mark shall be made by means of a separate application form.

(Forms of application as per schedule will be made available at offices of the Agriculture Department)

KILLINGS AT MEAT-EXPORT WORKS.

THE following table, compiled from Meat Producers Board statistics, gives particulars of aggregate killings and/or equivalent output at meat-export works in New Zealand for the past five years, ending 30th September in each case : —

Year.	Beef Quarters.	Mutton Carcasses.	Lamb Carcasses.	Pork Carcasses.	Boned Beef = Freight Carcasses.	Frozen Sundries = Freight Carcasses.	Total Equiva- lent in 60 lb. Freight Carcasses.
1924-25	458,549	2,224,263	4,750,164	35,753	263,738	54,961	6,438,056
1925-26	215,594	2,001,340	5,000,590	60,757	223,415	111,229	5,610,730
1926-27	184,331	2,094,354	5,381,121	74,633	242,044	69,534	5,956,708
1927-28	394,821	2,005,333	5,947,197	147,601	283,749	125,200	6,998,086
1928-29	151,115	1,751,979	5,971,557	159,297	161,597	153,331	6,152,695

Compensation paid for Stock and Meat condemned.—Compensation to the amount of £16,138 was paid out during the official year 1928-29 for 5,713 animals condemned in the field for disease under the Stock Act, and £15,086 for carcasses or parts of carcasses condemned for disease on examination at time of slaughter at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

Cream-grading.—" The system of cream-grading on a compulsory basis, and the payment of a differential price for 'Finest,' 'First,' and 'Second' grade cream, is now proceeding on fairly sound and uniform lines " (states the annual report of the Dairy Division for 1928-29), " and the general quality has shown some improvement during the year. On the whole cream-graders are doing consistent work. Few complaints have been received, the majority of suppliers recognizing that the old system of payment for cream irrespective of quality was unbusinesslike and not in the best interests of the industry."

The New Zealand Journal of Agriculture.

VOL. XXXIX. WELLINGTON, 20TH NOVEMBER, 1929.

No. 5.

CERTIFICATION OF GRASS AND CLOVER SEEDS.

SYSTEM ESTABLISHED BY THE DEPARTMENT OF AGRICULTURE.

J. W. HADFIELD, Agronomist, Plant Research Station, Palmerston North.

IN the *Journal* for July, 1929, was published an article entitled "Strain Investigation relative to Grasses and Clovers," by E. B. Levy and W. Davies, of the Plant Research Station. The article deals specially with the commercial perennial rye-grass seed as sold in the New Zealand markets at the present time, and sums up the results of research undertaken in connection with the various strains existing in this country. The writers claim that "what concerns New Zealand most at the moment are grass and clover types suitable for true permanent pasture"; and they bring forward data which show conclusively that "the Italian or annual type of rye-grass is markedly in evidence in commercial lines of perennial rye at present being harvested in New Zealand and offered for sale under the name 'perennial rye-grass' or simply 'rye-grass.'" As a result of their strain investigations they state that "New Zealand is extremely fortunate in that she has at hand a good perennial rye-grass type, probably equal to any commercial strain throughout the world—the Hawke's Bay type. Not that all seed from this source is genuine perennial; but at comparatively small expense the genuine crops may be identified, and, with these as a nucleus, mother seed can be produced; and this once grown will soon furnish a sufficiency of the genuine article for all New Zealand requirements at least."

These facts have such an important direct bearing upon our grasslands that the Department has decided to inaugurate in the current 1929-30 season the certification of true perennial rye-grass of the type that is now grown in the Hawke's Bay, Poverty Bay, and Sandon districts. A commencement will also be made with white clover and brown-top grass.

The present article outlines the organization set up to deal with the certification of grass and clover seeds. In a general way the objective is to establish an organization which will ensure the accurate distribution of grass and clover seeds of superior strain,

and to stimulate in every possible way the wider use and greater production of these seeds. It is hoped, with the co-operation of growers and merchants, to foster the export trade in these seeds by correct categorization of all exported lines.

THE SYSTEM IN BRIEF.

Following are the main points of the newly established system:—

(1) The paddock is recognized as the unit. Upon application the farm is inspected, and a plan drawn showing the exact location of each paddock or unit.

(2) Evidence is collected regarding such matters as age, origin of seed, &c.

(3) The determination of strain is effected by sample trials, grown at the Plant Research Station, Palmerston North, and checked up by a field inspection during flowering.

(4) Each grower is registered. He is given a number, and each paddock on his farm a letter.

(5) During or after threshing the sacks are branded and sealed in the paddock. They are tagged and again sealed after the seed has been machine-dressed, and a sample of the seed is taken, upon which is issued a purity and germination certificate.

(6) Records are kept of each line of seed, and returns of sales are made by merchants and growers to enable the seed to be followed up with a view to further certification.

CLASSIFICATION.

There are to be recognized three classes of certified perennial ryegrass, as follows:—

- (1) N.Z. Perennial Rye.
Certified Mother Seed.
(Blue tag.)
- (2) N.Z. Perennial Rye.
Certified Permanent Pasture Seed.
(Red tag.)
- (3) N.Z. Perennial Rye.
Certified First Harvest.
(White tag.)

One class of white clover, namely,—

N.Z. White Clover.
Certified Old Pasture.

One class of brown-top—

N.Z. Brown-top (*Agrostis tenuis*).
Certified free from Red-top (*Agrostis palustris*).

Other crops will be introduced as material and information become available, as, for example, Montgomery red clover, Kentish wild white clover, Akaroa cocksfoot, and crested dogtail.

As already stated, the paddock is considered the unit in certification of grass and clover seeds. The certificate will apply to the pasture and the produce therefrom, and once this is ploughed up or resown registration lapses.

Age is computed as the number of possible harvest seasons through which an area has passed, irrespective of whether it has been harvested for seed each year. For example, in the case of perennial rye, seed sown from January to June, 1929 (autumn-sown), produces first-harvest maiden seed in January, 1930, one-year seed in January, 1931, and two-year seed in January, 1932. Seed sown from July to December (spring-sown) is not likely to be harvested for seed in January, 1930, but should this occur the produce therefrom would be first-harvest maiden seed. Generally a spring-sown crop will miss producing a maiden-seed crop, and the first seed harvested from such an area would be "first harvest one-year seed" in January, 1931; two-year seed in January, 1932; and three-year in January, 1933.

Perennial Rye-grass.

To qualify as a *Perennial Rye Mother-seed Area*—

- (1) A sample of seed harvested from that area must have been grown at the Plant Research Station, and have been found sufficiently true to type to warrant it being registered for the production of mother seed.
- (2) The seed therefrom must be four-year seed or older.
- (3) The crop must be subject to a field inspection undertaken while in ear.

To qualify as a *Perennial Rye First-harvest Seed Area*—

- (1) Evidence must be forthcoming that the area has been sown down with certified mother seed.
- (2) It must be subject to a field inspection undertaken while in ear.

First-harvest seed is the first seed-crop harvested from an area, irrespective of whether it is one-, two-, or three-year-old seed. It is possible to have first-harvest maiden seed (which will be the most usual) or first-harvest one-year seed if the maiden seed is not harvested; or first-harvest two-year seed if neither the maiden nor the one-year seed has been harvested. Similarly, it is possible to have first-harvest three-year seed. Should four-year seed be the first seed harvested it would be accepted as permanent pasture under clause A (3) and B (see reference to permanent pasture below).

Merchants and growers who have purchased seed prior to the inauguration of this system, and with the object of sowing down for seed-production, must submit a sample with full details as to source of origin. These samples will be placed under trial, and a report furnished in about four to five months. If the trial report is satisfactory and the seed can be traced as four-year seed or older, it will be deemed to be equivalent to having been harvested from a mother-seed area, and the paddock from which it originated will be registered as a mother-seed area. Failing this the merchant or grower will miss one season, during which his first-harvest seed is under trial. This indirect means of registering an area, while not desirable, is necessary in the initial stages of certification so as to give equal rights to all.

To qualify as a *Perennial Rye Permanent-pasture Seed Area*—

- A (1) A sample of seed harvested from that area must have been grown at the Plant Research Station and have been

found sufficiently true to type to warrant the area being registered for the production of permanent-pasture seed ; or

- (2) Evidence must be forthcoming that the area was sown down with mother seed, and a satisfactory sample trial report furnished upon the first-harvest seed from that area ; or
- (3) Evidence must be forthcoming that the type of rye-grass is correct, and that the seed therefrom is four-year seed or older. (This is designed to admit, during the initial stages of certification, old pasture in regard to which there is no sample trial report available).

B. In all cases the crop must be subject to a field inspection undertaken while in ear.

SPECIAL CONCESSION DURING INITIAL STAGES OF CERTIFICATION.

Very few, if any, sample trial reports are available bearing upon the 1929-30 harvest, and it follows that few, if any, mother-seed areas will be registered. Rather than pass one or two mother-seed areas which, purely by chance, have been reported upon, it has been deemed more fair to certify only to permanent-pasture seed areas, with the exception of the possible few lots of first-harvest seed previously referred to.

During the 1929-30 season, therefore, all pastures (with the exception of first-harvest seed referred to above) registered as fit to produce certified seed will qualify as permanent pasture areas under A (3) and B above—that is, they are of the correct type and are producing four-year seed or older.

It will be realized that probably most of the paddocks to be accepted under this scheme will in reality be fit for the production of mother seed, and, with a view to stimulating seed-production and the sowing of this seed in the South and elsewhere without delay, the following means of ensuring a supply of mother seed have been devised :—

(1) Except for first-harvest seed referred to above, such seed as is accepted will be certified to as permanent-pasture. It should be bought and sold as such.

(2) A sample of each certified line will be sown at once on the Plant Research Station and reported upon. If sown in March the report will be ready in July—that is, before seed is usually sown in the South Island.

(3) In cases where the report indicates that the seed is equal to the standard of mother seed, the parties concerned will be notified, the seed recorded as mother seed, and the first harvest progeny of that seed will be eligible for certification.

(4) If the seed proves on trial not to be up to the standard of mother seed it will have to be considered still as permanent-pasture seed. Every endeavour will be made to avoid such cases, and the standard will be made high with this object. However, a small percentage is likely to get in, and allowance must be made in this connection.

RESOWING OF PERMANENT-PASTURE AND FIRST-HARVEST SEED.

A grower who sows down permanent-pasture or first-harvest seed cannot have the first-harvest seed produced off that area certified.

If, however, some of the first-harvest seed produced off that area is sent for trial, and the sample trial report is satisfactory, the second and subsequent harvests may be accepted as permanent-pasture seed, and eventually as mother seed.

The main difference, therefore, between the grower who sows down mother seed as compared with one who sows down permanent-pasture and first-harvest seed is that the first-mentioned is almost certain to have his first-harvest seed certified (and this is the most profitable seed crop), whereas the sower of first-harvest or permanent-pasture seed cannot have his first-harvest seed crop certified under any condition whatever.

Moreover, a grower who sows mother seed is more likely to have his second and subsequent harvests certified. It is considered desirable that growers who wish to grow certified seed should obtain mother seed for this purpose, but to make such a proviso would eliminate some quite good seed crops, which is not at all desirable.

White Clover.

White clover areas may be registered as fit for the production of "N.Z. White Clover Certified Old Pasture" if the seed (1) is grown in New Zealand, (2) is four-year seed or older.

White clover seed dressed out of rye-grass seed is eligible for certification if the pasture conforms to the conditions set down as to age.

Brown-top.

Brown-top areas may be registered as fit for the production of "N.Z. Brown-top Certified Free from Red-top" if a field inspection indicates that red-top is absent from that area.

General Conditions.

APPLICATIONS.

Application for certification should be made by the party owning the produce to be derived from the stand. Application forms are available from the Fields Superintendents of the Department.

These forms contain a clause wherein the grower signs a declaration as to the age of his pastures, and this information is corroborated from outside sources. The age factor has no bearing upon the certification of brown-top.

REGISTRATION.

Each farm receives a number, and each paddock on the farm receives a letter. To indicate the source of origin the registered numbers are prefixed by letters as follows:—

Southland	S.	Thames Valley	T.V.
Otago	O.	Bay of Plenty	B.P.
North Otago	N.O.	Central Plateau	C.P.
Central Otago	C.O.	South Auckland	S.A.
South Canterbury	S.C.	King-country	K.
Mid-Canterbury	M.C.	Taranaki	T.
North Canterbury	N.C.	Wanganui	W.
Marlborough	M.	Manawatu	MN.
Nelson	N.	Wairarapa	WA.
North Auckland	N.A.	Hawke's Bay	H.B.
Auckland Central	A.	Poverty Bay	P.B.
Waikato	WK.		

It is thus possible to trace back to the paddock of origin each line of certified seed.

FIELD INSPECTIONS.

In the case of rye-grass, field inspections may be viewed as supplying corroborative evidence upon the sample trial report, and in brown-top as determining that no red-top is present. In the case of white clover, age is the only factor, and field inspections prior to threshing are necessary only in the case of unregistered areas.

SEALING IN Paddock.

The responsibility must rest upon the grower to give due notice of his intention to thresh certified seed, and a certification officer is justified in refusing to seal the sacks if he has any reason to doubt the origin of any portion of the seed. The officer will endeavour to be present during or immediately after threshing, to count, seal, and brand the sacks. He will require the grower or some responsible person to sign a declaration guaranteeing that the sacks he has sealed and branded contain no seed other than the produce of the registered area.

MACHINE DRESSING.

Following paddock sealing the seed will in the ordinary course be sold, and its location lost, until notification is received from a merchant of his intention to machine-dress some certified seed. The responsibility must rest with the merchant to notify the local officer of the Department of Agriculture dealing with certification of his intention to machine-dress certified seed.

This will receive the officer's immediate attention, and he will (1) obtain the number of sacks and their weight; (2) remove the seals and allow machine dressing to proceed; (3) supply the number of tags required; (4) inspect the dressing returns; (5) obtain the number of sacks and weight of dressed seed; (6) seal up the sacks of machine-dressed seed; (7) draw a sample for purity and germination test, which is forwarded direct to the Department's Seed Analyst at Palmerston North.

PURITY AND GERMINATION CERTIFICATE.

This is prepared by the Seed Analyst, and is forwarded direct to the grower or merchant owning the seed. Each purity and germination certificate is numbered, and the certificate also bears the registered number of the seed to which it refers. The tags attached to the sealed sacks will also have printed on them the registered number and the purity and germination certificate number. In this manner the one can be always identified with the other.

To facilitate resales no names are mentioned on either tags or certificates. The seed is identified by the numbers already mentioned, and is bought and sold upon the evidence contained in the purity and germination certificate accompanying the line.

BLENDING AND RETURN OF SALES.

Merchants should give notice of their intention to blend, so that an officer may be present to check weights and remove seals.

The officer will then issue fresh tags, and take steps to obtain a purity and germination certificate of the blend. On both tag and certificate will be indicated the several registered numbers indicating the origin of the blend.

In due course merchants will be requested to send in a return of sales of certified seed to enable the seed to be traced to the grower, who may, at a later date, apply for certification.

MISCELLANEOUS.

It is not intended at present to make any charge for certification, but the usual charge of 2s. will be made for each purity and germination certificate issued.

The Department does not buy or sell certified grass and clover seeds. It is hoped that certification will not in any way interfere with the usual channels of trade. Farmers and others wishing to purchase certified seed should make arrangements through the merchants with whom they usually deal.

Further information may be obtained from the Fields Superintendent, Department of Agriculture, at Auckland, Palmerston North, Christchurch, or Dunedin, to whom also applications for certification should be made.

REGRASSING OF SECONDARY-GROWTH COUNTRY.

THE annual report of the Fields Division for 1928-29 makes the following statement on experimental work on secondary-growth country, which is being carried out mainly in Whangamomona County:—

The experiments on regrassing secondary-growth country have been continued, and some additional 30 acres have been sown. It is very gratifying to report that the species and mixtures recommended for these sowings are now being widely adopted by the hill-country farmers, and the work is really progressing of its own momentum. During the year our attention has been focused on the menace of hard-fern (*Paesia scaberula*). This troublesome secondary growth defies the ordinary methods of control. Firing is not entirely effective, owing to the green edge that will not burn unless the area has reverted to one entire mass of this fern. Crushing with cattle and hard-grazing sheep increases rather than decreases the amount of hard-fern; men's hands, wielding slashhook or grubber, are impotent against its spread. During the past three years spraying tests with arsenical compounds, mainly arsenic pentoxide (As_2O_5), have been thoroughly tried out, and it is very gratifying to report a marked degree of success. In 1926 approximately $\frac{1}{2}$ acre was sprayed; in 1927-28 approximately 26 acres were successfully dealt with, and in 1928-29 over 100 acres have been treated. Experiments are now afoot to clean up some 200 acres in all, and to find out over a period of years the amount of spraying and cost to keep this area entirely free of hard-fern. Control of hard-fern will put quite a different complexion on the control of other secondary growths—throughout the Taranaki back-country at least. Crushing is absolutely essential to control bracken-fern, and the menace of hard-fern induced as a result of hard crushing has been a big influence towards lighter stocking, and consequently has prolonged enormously the struggle against bracken. Hard-fern control assured, more confidence will be inspired in the regrassing of the country, and effective bracken-control methods may be vigorously applied.

DISEASES OF DAIRY COWS.

OBSERVATIONS IN EUROPEAN CENTRES.

(Continued.)

J. HILL MOTION, B.Sc. (Agric.), B.Sc. (Vet.Sc.), M.R.C.V.S., D.V.S.M., Animal Bacteriologist, Wallaceville Veterinary Laboratory.

II. CONTAGIOUS BOVINE ABORTION.

THIS interpretation of the fight against contagious bovine abortion is based on facts collected by the writer during his tour of the Continent of Europe, when he had the opportunity of discussing the control and elimination of epizootic abortion in dairy stock with well-known authorities on the subject, including Professor Bernard Bang, of Copenhagen, whose name has been closely associated with the problem for the past thirty-five years.

At the outset it must be remembered that no simple method of attack is available, but yet by following consistently certain now well-established practices the disease can be eliminated from the herd. Under certain circumstances these control measures may be costly and difficult, but even the smaller stockowners should be prepared at least to adopt certain practices to limit the spread of infection within their herds, and thus contribute towards a general organized attack, which may be provincial or national, but at all times under veterinary supervision.

The etiology, diagnosis, and control of contagious bovine abortion has engaged the attention of research workers for the past fifty years, while the act of abortion with its attendant sequelæ—metritis, sterility, &c.—still presents an economic problem of ever-increasing importance to the dairy-farmer, due mainly to the greater traffic in live-stock, at any rate in the more civilized countries. A considerable amount of excellent work has been done by both field and laboratory workers on this important disease of dairy stock, yet the farmer in most countries still anxiously awaits a satisfactory and economic method of control and elimination.

The losses generally associated with *Bacillus abortus* infection are only partly appreciated by farmers, and accordingly the true significance of the disease would appear to have been missed in the daily conduct of the milking-herd. Associated with the abortions and the loss of the calf are the birth of weak, if not non-viable, calves, which so often fall victims to other post-natal infections; next, the breeding abnormalities and insufficiencies associated with placentitis and endometritis, retained membranes, and sterility even; subsequently, the infection of the udder, the reduced milk-yield (generally considered at one-third of the total for the normal lactation), and perhaps, what is of even greater importance, the infection of the milk with *B. abortus*, presenting the possibilities of transmission to other animals, including man; finally, there must be added the greatly reduced sale value of the herd, under rational and honest conditions of animal husbandry where non-disclosure at time of sale permits of legal interpretation, whereas under certain systems of dairying, premature calvings associated with *B. abortus* infection present difficulties in regard to the seasonal lactations.

ETIOLOGY.

One of the most interesting pieces of research work yet published regarding contagious bovine abortion consisted in the important findings of Dr. Bang in 1896. Bang, assisted by Stribolt, examined the thick yellowish turbid fluid found between the uterus and the foetal envelopes in an aborting cow, and isolated in pure culture a very small organism, which they subsequently cultivated abundantly on artificial media. These experiments of Bang are now classic in that they established the etiology of contagious bovine abortion, and accordingly enabled other investigators to work on a sure foundation. As these researches have been extensively published, it is unnecessary to give the details here of the isolation and cultivation of the causal organism which is now known as *Bacillus abortus*, *Brucella abortus*, or *Alcaligenes abortus* (Bang). It will suffice, therefore, to state that the isolation of the specific organism from bovine tissues or secretions, including milk, or from the envelopes or discharges of the foetus, is possible only by means of special culture media, suitable environment, and a well-developed and special technique.

THE ACT OF ABORTION.

Abortion in bovines may result from many causes, such as physiological insufficiencies, traumatic injuries, or infectious diseases. When arising in the course of the latter the abortion may be sporadic, enzootic, or epizootic; but it is with epizootic or contagious abortion, caused by *B. abortus* (Bang), that we have to deal. It is now generally accepted that from 10 to 15 per cent. of abortions in a herd are due to other causes than this infection, although frequent abortions invariably suggest such infection.

It is interesting to note that according to M. Rinjard, of the National Research Laboratory, Alfort, France, from the examination of some thirty thousand blood-samples from bovines, 10 per cent. of abortions were due to some other organism than *B. abortus*. M'Fadyean and Stockman in Britain, Theobald Smith in America, Thomsen in Denmark, and Gminder in Germany have all described, in both sheep and cow, abortions caused by a "vibrio." Theobald Smith and Taylor in America report *B. abortus* in 57 per cent. and vibriones in 24 per cent. of 109 cases examined. Wall and Magnusson in Sweden, and Theobald Smith and Taylor in America, have discovered *Bacillus pyogenes*. Bang, Thomsen, and later Plum, in Denmark, have shown that many cases of abortion are due to *B. tuberculosis*—up to 3 per cent. of the cases examined; and of these 5 per cent. were due to avian tuberculosis. Mould infections of the uterus, chiefly mucus and aspergillus, have been described as causing abortion, by Theobald Smith, Carpenter, Birch, and Gilman, in America, and also Bang and Bendixen in Denmark. Other causes have been recorded—namely, streptococci by Thomsen in Denmark, and Oppermann in Germany, paratyphosis by Schermer and Ehrlich in Germany, and finally specific infectious diseases—for example, foot-and-mouth. These facts are recorded here because only too often figures are published regarding abortion in a herd in vaccination experiments without the true cause of such manifestations being carefully diagnosed.

The act of abortion cannot be taken as the criterion of infection by *B. abortus*, and the number of abortions in a herd cannot be assumed as an indication of the extent of infection, whereas the mere fact that there are no abortions does not necessarily mean freedom from infection. Abortions would appear to be more prevalent among second calvers. The earlier in pregnancy in which abortion manifests itself, the greater is the chance of an abortion in the subsequent pregnancy. It has been stated that 75 per cent. of cows which abort once develop a so-called immunity, or resistance to subsequent infection, and do not abort again. Cows often abort a second time, and in many cases even three times in succession, whereas others may appear to recover but succumb to a later infection. The earlier in pregnancy that infection occurs the longer the act of abortion is delayed.

SPREAD OF INFECTION.

Contagious abortion in a herd is insidious in its onset and slow in its progress, and infection may be present in a stock for many weeks or even months before any actual cases of abortion occur. It has been recorded that the act of abortion may become manifest as early as thirty days after infection in the case of the pregnant bovine.

The disease is generally introduced into the herd by the addition of an infected animal from another farm, usually a pregnant cow, although a newly purchased bull may also carry the organism localized in the genital tract. The temporary removal of cows for breeding or show purposes is also a fertile source of spread of the infection, and equally so the admission to the farm of infected cows for service, when infection may be left with the herd bull, or yards and paddocks may be contaminated with genital discharges. The method of infection is by ingestion of infective material, either artificial feeding-stuffs, pasture, or drinking-water, contaminated with discharges from an aborting cow. Again, infection may result from cows licking each other, and particularly so when cows are in œstrum, or during normal involution after the act of abortion. Bulls may also become infected in this way. Cows artificially infected by feeding living cultures have given a positive blood-test as early as three weeks. Infection may be carried in the milk of non-pregnant cows, and thus calves contract infection, which very soon leaves the body by the digestive tract, thus contaminating the pasture. Experimental methods have shown that the specific organism may be introduced into the animal-body by all possible modes of entry, but, in view of the contaminated nature of the natural surroundings, the digestive tract would appear to offer the most reasonable portal of entry. This is now generally accepted as the chief method of infection, thanks to the researches of Bang, McFadyean, and Stockman.

Vaginal infection is not now considered as important, since at time of œstrum the conditions in the uterus are not compatible with those favoured by *B. abortus*. A mass infection per vaginum may result in a direct uterine contamination occasionally, but this would surely be rare, whereas the antiseptic conditions existing in the vagina would result in an abortive infection. As for transmission by the bull during the act of coitus, the almost universal opinion held to-day is that it may be possible but very rarely occurs. Yet the elimination of the organisms in the seminal fluid may reasonably furnish a source of

infection by contamination of the pasture. Physical contact would appear to offer opportunities for spread, and accordingly the paddock would favour infection more than would the cow-shed. The viability of the organism is important in outlining preventive measures. It may be said that the contagion is not long-lived under field conditions, although within a mummified foetus the organisms can survive for as long as nine months. Again, the spread of infection by attendants would appear to have been overrated, since mediate contact has been proved to be unimportant. This is a very important finding, and one which would permit of a more practical interpretation of the elimination of contagious abortion by segregation, a problem which is discussed later.

Having thus considered the means by which the disease is introduced into a herd, and also the method of infection and spread, it will suffice to conclude this part of the survey by considering the incidence and localization of the organism in the bovine species, and the chief sources of contagion.

In bovines, at least, the receptivity varies according to sex, the pregnant female offering the environment of choice, whereas the male harbours a more passive infection. There is also a difference according to age; a young bovine does not offer favourable conditions, for the calf nourished with infected milk (the milk of its mother) shows the presence of infection by the development in its blood of the power of agglutination, but when the infective nutriment is withdrawn it very quickly rids itself of all infection. In the case of virgin heifers, one recognizes the marked tendency to throw off infection, except in the circumstances when they remain in contact with infected adults, yet the infection disappears spontaneously if they are removed from the risk of repeated infection.

The localization of the organisms in the animal-body is of importance also. All the tissues of the body do not offer a suitable medium for the development and retention of *B. abortus*. It is the gravid uterus which supports the heaviest infection; the foetal membranes, the amniotic fluid, the aborted foetus, the supra-mammary glands, and the udder in the cow, the epididymus and the vesicula seminalis in the bull, are the situations which permit of multiplication or of localization of the organism.

At the time of calving or abortion, and during the days immediately following, the virulent bacilli are liberated with the foetal fluids as a veritable bouillon culture, with the foetal membrane and aborted foetus as a mass infection, and in the subsequent uterine discharge so long as this continues, which may be only a few days for normal involution, but often for many weeks when metritis supervenes. Here, then is the chief source of contagion.

When cows are permitted to calve or abort in the common herd the extent of spread of infection would be considerable, when it is realized that in the third year of a serious outbreak it is not uncommon to find 50 to 60 per cent. of cows aborting, and thus disseminating the infection throughout the herd by the contamination of pastures, yards, drinking-water, and feeding-stuffs even.

Following the act of abortion, the organisms are eliminated with the normal discharges, and usually in about three weeks the uterus has freed

itself of all infection. Only on one occasion have the bacilli been demonstrated after fifty-one days. The bacilli still remaining in the system migrate to the now functioning udder and may be eliminated in milk—at least with 30 to 40 per cent. of infected cows.

Infection in the cow-shed or milking-bail may occur from contamination with milk, or infection may be carried to other lactating members of the herd by the hands of the milkers or the teat-cups of the milking-machines; and, what perhaps is also an important problem, infection may be conveyed to human beings when the milk is consumed. Infection may then remain localized in the udder and supra-mammary gland for years, and the animal becomes a "carrier" of infection. Many of these carriers to all appearances calve normally, but the contents of the uterus are usually infective, since the udder serves as a reservoir of infection for subsequent pregnancies.

Contagious bovine abortion can no longer, therefore, be considered as a "specific uterine catarrh," a disease of the foetus and its membranes, but rather as a general chronic infection, in which the act of abortion is certainly not a necessary consequence of the disease. It is important to recognize that the recently infected cow which calves to time is almost certain to be a "spreader," and perhaps, therefore, of the greatest danger to the herd.

Carriers may also be represented by the bull, but they are of much less importance, especially in well-managed herds. It is the vesicula seminalis which are most frequently affected, and it is with the secretions that the organisms may pass out; when this takes place, even in the absence of coitus, contamination of the surroundings may occur as noted above.

DIAGNOSIS.

The existence of *B. abortus* infection in a herd can only be satisfactorily diagnosed by laboratory methods, since, as has already been stated, the number of abortions is no indication of the extent of infection. The fact, however, that a number of animals calve prematurely and at different times is suggestive of the clinical manifestations of contagious bovine abortion. Microscopical and cultural examination of material from the placental exudate, or from the liver, heart-blood, or intestines of the aborted foetus, frequently demonstrate *B. abortus* alone as the invading organism.

Serological reactions must perforce be resorted to in diagnosing the disease in the herds and in estimating the extent of its progress. The agglutination or blood test is the most important means by which diagnosis is confirmed. This test depends upon the power of the blood serum of an infected animal to cause the bacilli suspended in a weak saline solution to clump together and fall to the bottom of the test-tube. This test takes twenty-four hours to carry out, since incubation at a definite temperature is necessary before the result can be known. It is to be remembered that this test is not a test for the act of abortion, and does not indicate that a cow has already aborted or will abort, but rather a test for anti-bodies circulating in the blood resulting from the response of the animal to the presence in the system of the organisms causing contagious bovine abortion.

The agglutination test as carried out in laboratories of repute is exceedingly reliable, since under such circumstances the technique and interpretation is left to experienced workers. Objections have been raised regarding the efficacy of the test, but usually these result from careless methods and want of organization in handling large numbers of samples. The extent of the reaction to the test, or, in other words, the agglutinating titre, is very variable amongst the individuals within the herd, and also equally so during the course of the disease. Such differences and fluctuations will indicate that the titre is not a static but a variant. A cow which harbours *B. abortus* may give a negative reaction even up to one month after the act of abortion, and then suddenly change to a definite positive. A definite high reaction will indicate that the animal will probably remain infected for a very long time, even indefinitely, and when such a reaction disappears it is generally a very long and gradual process extending to many months or years. In contrast to tuberculosis in bovines, it is interesting to note that once the animal is a reactor it is not always a reactor. Doubtful reactors or low reactors often cease to test positively when the infection is thrown off, but, again, they may become chronic reactors or carrier cases. Many reactors never abort, but calve normally a live calf, and continue to spread infection during each calving. From what has been said it is evident that the result of one test is not sufficient to exclude doubtful or negative reactors, and accordingly cases of incubation, latent infections, and recently aborted cows must be eliminated by several tests at four to six weeks intervals.

Several modifications of the agglutination test have been devised in order to reduce the time occupied in carrying out the test, and also to furnish a suitable technique for use in the field, but since the principle involved is very much similar, details are omitted here.

Another method of diagnosis which may facilitate work in the field depends upon the reaction on the part of the animal to intravenous, subcutaneous, or intracutaneous injection of products of disintegration or extracts of the dead bacilli. The response may therefore be thermal, or merely a cutaneous hypersensitiveness, similar to the reaction obtained by the use of tuberculin in the diagnosis of tuberculosis. The true nature of such reactions is not very well understood, and accordingly a satisfactory procedure is very difficult to determine. If the success claimed by the authors of such tests with bacterial products or residue can be satisfactorily repeated, a most promising diagnostic procedure will become available for employment in the herd. Further reports will be awaited with interest by all workers and all owners of live-stock.

The clinical manifestations and symptomatology of the disease within the herd may be suggestive of contagious bovine abortion, but for definite diagnosis reliance must be placed on microscopical examination of material from the cow which has aborted or from the aborted foetus, confirmed by one or other of the serological tests utilized in the examination of a blood-sample taken from the cow not earlier than fourteen days after the act of abortion.

For the examination of milk for the presence of *B. abortus* the agglutination test has been suggested, but more satisfactory results are obtained by guinea-pig inoculation or suitable cultural methods.

Control and Elimination of the Disease.

Having so far satisfied ourselves of the efficacy of the methods of diagnosis of contagious bovine abortion, measures for the effective control and elimination of this disease may now be advanced and discussed. The problem may conveniently be dealt with under three headings—(1) Sanitary police measures or State intervention; (2) measures for the prevention of the introduction of the disease into herds free from infection; and (3) elimination measures in infected herds. Towards this end it will be necessary to apply one or more of the following measures in order to combat successfully this bovine scourge: (a) Diagnostic control, (b) hygienic precautions, (c) isolation requirements, (d) vaccination or immunization.

A very careful diagnosis of the extent of the infection in the herd is absolutely essential before methods of isolation can be devised to meet the requirements of the owner and at the same time suffice to keep in check the ravages of the disease. The hygienic measures generally recommended are such as should always be enforced in breeding or other herds, in order to prevent the introduction and to limit the spread of both infectious and non-infectious disease. The isolation requirements can only be outlined by the veterinarian in charge, and are governed by the nature of the infection, the method of spread, and the viability of the organism. Finally, where vaccination is possible and the situation warrants its use, it must on no account be proceeded with if all or any of the complementary measures are not being carried out to the letter, otherwise the veterinarian in charge will only have himself to blame for unsatisfactory and undesirable results.

(1) SANITARY POLICE MEASURES OR STATE INTERVENTION.

The question of the eradication and control of diseases of live-stock which are insidious in their onset and chronic in their progress is a very difficult one for many reasons. Firstly, the early notification and clinical diagnosis is always a difficulty; the gross carelessness on the part of the stockowner facilitates the spread of the contagion; the efficacy of laboratory methods of diagnosis is often in question; and, finally, the payment of compensation for total loss may often be the deciding factor. The eradication of tuberculosis has been attempted in most countries, but it is only in those such as the United States, where the Government is ready to give all financial assistance for administration, diagnosis, and full compensation that progress seems to have been made. Considering now contagious bovine abortion, we have a chronic disease of dairy stock second only to tuberculosis in respect of the losses occasioned thereby. In the smaller countries, such as New Zealand, the only successful policy is to get the stock-owners interested in the work of elimination and by united efforts to clear up the individual herds. The details of such a scheme would have to be carefully drawn out, but it will suffice here to suggest that in addition to giving veterinary service, either free or at a nominal charge for diagnosis and vaccination (if the latter be advisable), an order prohibiting exposure of infected animals in locations likely to transmit infection to healthy stock belonging to others would have to be put into operation.

In Great Britain, Denmark, and Norway such an order has been made by the Government, and it may be summarized as follows: "Prohibition of exposure in the market, fair-ground, or sale-yard; prohibition of sale without notification of disease; prohibition of service without notification; prohibition of turning out to graze on any common or unenclosed land, in a field or other enclosed place not fenced so as to prevent cattle entering or escaping, on the side of the highway, on any land on which there are cattle which are not the property of the owner of the cow so exposed." This applies by law to any cow or heifer which to the owner's knowledge, or according to information furnished to him, has calved prematurely within two months immediately preceding such exposure. The text of the order in the three above-mentioned countries is drafted on the same lines.

So far as the writer is aware, no cases have been dealt with summarily for violation of the order in Great Britain, but the fact remains that the onus of disclosing and therefore of proving the existence of *B. abortus* infection as the cause of premature calving rests with the owner of the animal. In view of the fact, however, that practically no progress has been made in Britain towards the elimination or control of contagious bovine abortion—or, in other words, that no organized attempt has yet been formulated—it would appear that possibly this order is of no value; but it can be appreciated that so far as legislation is concerned the Ministry of Agriculture has carried into effect its part of the combat against this disease.

At the same time, it may be mentioned that in Britain a living vaccine is supplied at a nominal charge to veterinary surgeons, and a small amount of laboratory diagnosis is carried out at the Government laboratory. In practically every country of Europe also diagnosis is carried out and living vaccines are supplied.

It would appear, then, that only when the stockowners are alive to the grave losses occasioned in their herds and bestir themselves to make an effort on their own behalf to eliminate the disease will it be possible to understand how Government intervention can prove of value in what must be considered in every country a national problem.

(2) MEASURES FOR PREVENTION OF INTRODUCTION OF THE DISEASE INTO A CLEAN HERD.

Fortunately in every country there are still herds which are free from infection with *B. abortus*, and accordingly it is imperative that one should be able to suggest the means whereby the introduction of the disease can be prevented. Many small herds are free from *B. abortus* infection, but few of the very large herds contain no reactors to the initial blood-test. Herds which are free from the disease are invariably those whose owners raise their own stock, never purchase from without, and allow no interchange of stock whatever. The methods of management in such clean herds would naturally suggest the means towards this end.

It has been realized that in *B. abortus* infection we are dealing with a disease of relatively low contagion, and accordingly for a clean herd to become infected it is necessary to introduce an infected bovine, or temporarily expose a non-infected animal in an infected environment. Contact is therefore necessary, either with regard to the animals or

by bringing contaminated material into the clean herd. Here, then, is the keynote to success in preventing the introduction of the disease into an abortion-free herd.

Recent Purchases.—The first of the only two real risks of contamination is the purchase and introduction into the herd of an animal either in the incubation stage or in a state of latent infection. All adult animals purchased should be immediately isolated and subjected to at least three agglutination tests, at four to six weeks' interval; in the case of pregnant females one of the tests must be carried out two to three weeks after calving (or abortion).

In order to shorten the period of isolation, it is advisable to buy young cows as near as possible to the first calving, when an agglutination test is carried out at time of purchase, and also at two to three weeks after calving. In view of the fact that young stock quickly eliminate infection from the system, it is also advised that virgin heifers and bulls of one year should be purchased, isolated out of doors, and tested at time of purchase, and again after several months. It is advisable, however, that before having the heifers served, and before using the bulls, they should have passed three agglutination tests. It may happen that these young bovines have come direct from an infected herd, when positive results may be obtained from the test, but on isolation they will generally throw off the infection very quickly.

Temporary Removals.—Animals belonging to the herd should not be exposed to infection outside and then returned to the farm—for example, exposed at saleyards and shows, grazed on unenclosed pastures or public highways, or even in fields improperly fenced where other bovines have access, removed for service to bulls in adjoining herds; and, finally, animals from neighbouring farms should not be allowed to come in for service or otherwise. Although the bull is not considered as likely to transmit infection, there remains the risk of a visiting cow contracting the disease by consuming contaminated food or water. As already indicated, these control measures are the compulsory provisions of the contagious abortion orders of Britain, Denmark, and Norway.

Special Bulls.—The rigid methods of isolation necessitates the keeping of a bull or bulls to be used in the herd only. Where desired, a special bull may also be kept for the purchased animals if this part of the business is extensive.

The Calving Paddocks or Boxes.—These may be considered as absolutely essential in a breeding-herd, and more especially so for newly purchased cows. Calving-boxes, where provided, should be suitably constructed for rapid and efficient cleansing and disinfection. Disinfection should be continued until the result of the blood test immediately following calving is known.

Hygienic Measures.—Disinfection and cleansing should be carried out at all times, and antiseptic and aseptic precautions in particular in parturition work.

Agglutination Tests.—It is not sufficient to assume that the herd is free from infection because no abortions have occurred to date, and therefore it is absolutely necessary to carry out an initial blood test of all animals of breeding-age in the herd. Subsequent testing should be carried out twice a year, and later only once, until the incidence of the disease in the country or district justifies a longer interval. An

agglutination test, performed two or three weeks after calving, should be made the rule in all cases for the first year at least, since this is the most likely time for a positive result to be obtained.

As already stated, where it is necessary to purchase additions to the herd, bovines so introduced should be bought on the test. It must be noted, however, that non-reacting cows from a herd containing reactors may possibly be infected, but in the incubative stage of the disease. This is especially so in the case of pregnant cows.

It is obvious, then, that all purchases must be isolated till they they have passed at least two additional tests at four- to six-week intervals. The only procedure which can be recommended as relatively safe is to purchase from herds certified clean by means of the test animals to be subsequently tested as stated above—that is, of course, for addition to clean herds as determined by the blood test.

Protective Inoculation or Vaccination.—The efficacy of the many methods of serum and vaccine therapy suggested for the protection of clean herds has not been proven, and accordingly in this respect there is nothing of value to report here.

(To be continued.)

BLISTER DISEASE OR CRACKING OF APPLES. SUCCESSFUL REMEDIAL MEASURES IN NELSON DISTRICT.

B. G. GOODWIN, N.D.H. (N.Z.), Orchard Instructor, Christchurch (late of Mapua).

MANY varieties of both apples and pears are subject to a disease which causes cracking of the skin, in some instances extensive. Especially is this the case with the Dunn's Favourite apple, which will be referred to more particularly in these notes. This variety has in the past been extensively planted for export, but owing to the trouble with cracking experienced during recent years, the quantities exported have diminished by thousands of cases. A large number of fruitgrowers have already reworked this apple with other varieties, being of the opinion that nothing could be done to successfully combat the disease.

Cracking of Dunn's has been general throughout New Zealand, irrespective of difference in climatic conditions or quality of soil, both rich and poor classes of land giving similar results in this respect. The appearance of the disease on both trees and fruit is so well known to growers of the variety that a description might be considered superfluous. However, for the benefit of any orchardists who are not so familiar with the trouble a brief description will be given.

On laterals it is abundant on one- and two-year-old wood. On this growth it appears in the form of small irregularly shaped blisters, which stand above the surface of the bark. These blisters may occur singly, scattered over the surface of the bark, or aggregated into groups forming large and irregular areas. Generally they have an unbroken surface, but on older wood the blisters not uncommonly crack across, giving to the bark a rough and scabbed appearance. When the blisters are scattered their presence is difficult to detect, but when confluent they are quite conspicuous.

On fruits a russeted condition is produced, but if affected when young large unsightly cracks may be formed. These are more prevalent near the stem end of the fruit, but occasionally are to be found on the side, and where badly affected the cracking extends completely round the apple. These cracks are usually large, crescentic, possess rounded edges, and are quite rough to the touch.

The trouble may be regarded as due more to general debility of the tree than from other causes, the *Conothecium* disease (to use the mycological name) being an after-effect. This is suggested by the fact that practically all the sound fruit to be found on trees that are affected through not having received proper treatment are situated near the top, where the growth is stronger. The lower buds have become so weakened and immature through the debility of the trees that it is impossible for them to maintain sufficient vigour to produce sound fruit.

Following up these deductions it is obvious that the stamina of the tree should receive first consideration in order to produce fruit free from cracking. This increased stamina can be induced by practising a system of heavy pruning, combined with manuring and cultivation. All lateral wood growths and subleaders should be removed entirely, and where fruit spurs are prolific these should be thinned out and shortened in length, leaving only plump and well-formed buds. Where main branches or leaders are numerous these should be reduced, leaving not more than ten to fifteen, according to the growth-inducing conditions of the soil. Such a system of pruning not only assists in restoring the vitality of the tree (which is the main object in view), but also the greater portion of the affected wood is removed.

A brief account of some of the many successes that have been obtained in Nelson Province, where experiments have been recently carried out under the writer's supervision, will now be given.

In the Upper Moutere district, from an orchard bearing a heavy crop of Dunn's apples only between forty and fifty cases were fit to be exported during the 1928 season. The system of pruning as described was carried out during the following winter, together with applications of basic slag, blood-and-bone, and sulphate of potash. The results obtained were astounding, the quantity of apples exported from the same trees during the 1929 season amounting to 376 cases, an increase of over 300 cases. Moreover, at time of writing there was a splendid show of fine healthy fruit-buds for the next season.

In another orchard at Mapua, during the 1927 season, only sixty-five cases of Dunn's were fit to be exported owing to the fruit being badly cracked. Following out the system of pruning advocated the export from the same trees has increased to two hundred and fifty cases in 1928 and 1929.

As showing that hard pruning is essential to restore vigour to the Dunn's variety and enabling the trees to produce fruit free from cracking, another local case may be mentioned. An orchardist did not prune a portion of his Dunn's, intending to work them over with some other variety, but this he failed to do through pressure of other work, and the trees, being in a debilitated condition, practically failed to set any fruit; what few apples did set were worthless, owing to being cracked to pieces. The remainder of the trees, which were pruned

back severely (otherwise having exactly the same treatment as the first-mentioned trees), set a good crop, having a nice clear skin, and practically free from any sign of cracking.

As already indicated, however, pruning alone is not sufficient to combat the disease. Manurial treatment is also necessary to promote vigour, and for this purpose the following manurial combinations have been proved to materially assist the trees to produce payable crops, the quantities named being the per-acre rate: No. 1: 3 cwt. basic slag, 2 cwt. blood-and-bone, 1 cwt. muriate of potash. No. 2: 1½ cwt. sulphate of ammonia, 3 cwt. blood-and-bone, 1 cwt. sulphate of potash. No. 3: 3 cwt. fish-manure, 1 cwt. muriate of potash. One or other of these combinations should be applied as follows:—

No. 1: The basic slag (approximately 3 lb. per tree) at the latter end of May or early in June, ploughed in, as it is a slow-acting manure. The blood-and-bone (2 lb. per tree) and the muriate of potash (1 lb. per tree) in early spring—early in September—and either ploughed or well disked in.

No. 2: Blood-and-bone (3 lb. per tree) and sulphate of potash (1 lb. per tree) ploughed in at the latter end of August. Sulphate of ammonia (1½ lb. per tree) lightly cultivated in at the beginning of October.

No. 3: Muriate of potash (1 lb. per tree) ploughed in early in June. Fish-manure (3 lb. per tree) in early September, after the second ploughing is finished.

Whatever combination is used, it is also necessary to apply lime at the rate of 1 ton per acre, where such has not been recently applied.

Lastly, thorough cultivation must be recognized as essential throughout the season. Ploughing twice is far better than ploughing once. The soil should be turned over in early autumn—that is, the end of May or beginning of June—and again in early spring, immediately after the green-tip spray has been applied—usually about the early part of September. The ground should then be disked; and, as too much disking is inclined to make the soil run together and dry out, from then onwards it should be kept stirred up by the use of the cultivator. The number of cultivations given can only be determined by weather conditions; if dry conditions prevail more cultivation will be required than if the weather is wet.

If these essential factors of pruning, manuring, and cultivating are properly attended to, the growers of Dunn's Favourite need have no doubts about the production of a good crop of marketable fruit.

Exports of Stud Stock.—The following stud stock was exported during the year ended 31st March last: Sheep, 2,669; cattle, 164; horses (draught), 10. In addition, the usual shipments of trotting and thoroughbred horses were made to Australia, principally for racing purposes, but most of these animals eventually return again to New Zealand.

Butter Manufacture without Preservatives.—Manufacture of butter without preservatives, in order to comply with the British Ministry of Health's requirements, has been in operation during the whole of the past year. Tests for preservatives in butter intended for export from the Dominion have been carried out by the Dairy Division's Graders at intervals, and in no instance was it found that preservatives had been used, neither have any complaints been received from Britain in this connection.

OFFICIAL HERD-TESTING OF PUREBRED DAIRY COWS.

SURVEY OF THE SECOND SEASON'S WORK, 1928-29.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

A BRIEF review and summary of records of the first season's operations under the official herd-testing system appeared in the *Journal* for September, 1928, and reference thereto will show that 31st July was accepted as the closing-date for the O.H.T. year. The second year's work, however, brought out the fact that at the same date in 1929 so many testing periods were incomplete as to make it advisable to select a later date for the termination of the season and as a basis for future tabulations. On account of the fact that the commencement of test for O.H.T. cows—similarly to C.O.R. entries, though perhaps to a lesser extent—is spread over a considerable portion of the year, no dividing-line which will make the summary wholly complete can be drawn. Up to the present, however, it would appear that 30th September is the most suitable closing-date, and consequently the present tabulation includes all cows which have completed their test between 31st July, 1928, and 30th September, 1929.

The fact that the Official Herd-test is conducted as an adjunct of the Certificate-of-Record system, and is, broadly speaking, confined to the testing of registered purebred dairy cows, implies the assumption that C.O.R. and O.H.T. support will run on parallel lines, and that no very marked variation from year to year in the numerical strength of one may reasonably be expected without a corresponding trend in the other. It must also be recognized that the Official Herd-test is a kind of halfway mark between the Group Test and the C.O.R., and therefore cannot be expected, nor was it intended, to assume very large proportions. At the height of the season under review testing was carried out for 1,666 O.H.T. cows in the hands of some 128 C.O.R. breeders, as compared with 1,550 cows and 102 breeders for the preceding year. The number of cows actually covered by the entire season's work was 1,970.

This must be accepted as very satisfactory, and the work should be of considerable benefit to breeders and dairymen generally by way of getting a greater number of butterfat records behind our purebred dairy cows. There is room for an appreciable extension in the testing of these animals, as it would appear that the number of registered purebreds with authenticated yields represents too small a proportion of the herd-book entries. A stage seems to have been reached where one must recognize that the mere fact of an animal being in the herd-book of one of the dairy breeds is not sufficient, and that there is need for the testing of a larger proportion of our purebreds, together with a consequent classifying and weeding-out by means of an advanced or selective register or some other method. The Official Herd-test, linked up with the C.O.R. test, provides the foundation for an effective and economical movement in this direction.

Table 1 indicates the general position regarding number of breeders, number of cows tested, average production, &c., for the past season, the first year's results having been included for purposes of comparison. In the present summary the classification on the basis of all cows on test six months (180 days) or more has been retained as the most suitable for the majority of the principal tabulations. From the point of view of estimating the merit of average yields and the results generally, it may be unnecessary to remind readers that the O.H.T. is a ten months' test, 305 days being the maximum testing-period permitted by the rules governing the system. Table 1 does not include some 159 cows other than registered purebreds which were tested by special arrangement during the past season. There is also the point that although the total number of cows tested appears as 1,636, there were 165 cows registered purebreds and 10 cows other than registered purebreds withdrawn or dry prior to the 180 days, thus making a total of 1,970 cows. Moreover, had this table been based on cows on test 100 days or more the number would have been 1,736, indicating that 100 cows dropped out between 100 and 180 days.

Table 1

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days in Milk	Milk.	Butterfat.
Season 1927-28.					
				lb.	lb.
Jersey	73	605	274	5,709.9	305.79
Friesian	20	376	263	7,526.8	264.29
Ayrshire	2	65	253	5,712.6	232.02
Milking Shorthorn	5	53	252	5,646.9	228.64
Red Poll	2	28	283	6,254.1	267.18
Totals	102	1,127	268	6,326.8	283.10
Season 1928-29.					
Jersey	99	817	276	5,705.1	306.30
Friesian	24	546	274	7,976.8	275.17
Ayrshire	8	106	282	7,182.8	280.89
Milking Shorthorn	7	108	266	6,496.6	250.39
Red Poll	4	59	261	5,901.1	239.77
Totals	142	1,636	275	6,618.3	288.17

The table requires no comment, and the position indicated is extremely satisfactory, each branch of the tabulation except one showing an increase over the first year. For those who are interested in making comparisons with other commonly adopted classifications it may be stated that an average compiled on the 100 days or more basis, as used for ordinary dairy herd-testing returns, gives a result of 280.33 lb. butterfat in 267 days, as against 240.59 lb. fat in 242 days for all cows on herd-test in 1928-29. The average C.O.R. cow in 1928 gave 469.53 lb. butterfat. In placing an estimate on the O.H.T. average yield one must bear in mind that the large majority of the cows are no doubt under ordinary dairy-herd conditions, and that in most cases the O.H.T. is likely to be a trial ground for untested cows rather than an attempt to break records with picked individuals.

Table 2, which also includes all cows tested 180 days or more during the period under review, gives particulars of the highest and lowest individual herd yields within each breed. While this table is interesting and is of a type commonly used, there are so many contributing factors that from a practical point of view the information is quite an inadequate foundation for judgment. One would require to know, among other things, the class of land, the treatment which the cows received, whether the higher averages represented special selections, and certain other influencing items as well.

Table 2.

Breed.	Highest Herd.			Lowest Herd.		
	Number of Cows.	Average Days.	Average Butterfat.	Number of Cows.	Average Days.	Average Butterfat.
<i>Season 1927-28.</i>						
			lb.			lb.
Jersey	4	305	514.71	2	257	197.79
Friesian	16	290	361.33	38	220	192.65
Ayrshire	27	265	255.39	38	245	215.41
Milking Shorthorn	6	283	288.87	5	219	205.62
Red Poll	24	285	277.13	4	268	207.45
<i>Season 1928-29.</i>						
Jersey	3	305	541.76	2	195	180.93
Friesian	6	305	417.48	12	263	219.30
Ayrshire	11	264	339.48	23	270	192.38
Milking Shorthorn	7	267	337.92	4	261	217.33
Red Poll	34	251	261.91	19	266	197.46

In Table 3 are given particulars of the highest and lowest cow for each breed. It will be noted that length of lactation plays a considerable part in most of the differences. Some very creditable performances are recorded among the highest yields, particularly when it is remembered that these are ten-monthly, not yearly, returns. It should also be stated that, except in the Ayrshire breed, the lowest producers were only two-year-olds.

In Table 4 is given an analysis of production for all breeds and for all cows tested 180 days or more. The corresponding table for last year is repeated for the convenience of those who desire to make comparisons. It is interesting to note the very desirable heavier clustering of records around the average-yield columns, and the comparatively small percentage in the lowest subdivisions. In last year's review one or two comparisons were given which it would seem may be repeated with advantage. The production of the average dairy cow (in milk and dry) in New Zealand for last year is estimated at 212 lb. butterfat, so that 1,408 of the cows under review equalled or exceeded that production. Our average tested cow for last season produced 240.59 lb. butterfat, whereas it is found that over 1,150 (70 per cent.) of last year's O.H.T. cows bettered that yield. The 159 cows other than registered purebreds which were tested under the O.H.T. system during the period under review gave an average yield of 246.73 lb. butterfat.

Table 3.

Breed	Highest Cow.		Lowest Cow.	
	Days.	Butterfat.	Days.	Butterfat
<i>Season 1927-28.</i>				
		lb.		lb.
Jersey	305	603.60	211	95.03
Friesian .. .	305	560.53	194	106.94
Ayrshire .. .	305	398.79	225	107.84
Milking Shorthorn	305	419.29	199	120.68
Red Poll .. .	305	447.52	254	144.82
<i>Season 1928-29</i>				
Jersey	293	652.48	264	100.23
Friesian .. .	305	587.27	202	68.72
Ayrshire .. .	305	432.22	182	153.40
Milking Shorthorn	305	607.42	217	117.48
Red Poll .. .	234	373.12	257	113.36

Table 4.

Breed.	50-100	100-150	150-200	200-250	250-300	300-350	350-400	400-450	450-500	500-550	550-600	600-650	650-700	Total for Breed.
<i>Season 1927-28.</i>														
Jersey	2	11	44	84	153	147	92	49	13	6	3	1	..	605
Friesian .. .	..	28	59	82	86	63	38	16	3	1	..	..	..	376
Ayrshire .. .	..	13	13	11	15	11	2	..	..	..	..	..	..	65
Milking Shorthorn	..	5	16	11	13	6	1	1	..	..	..	..	..	53
Red Poll .. .	..	1	3	6	11	5	1	1	..	..	..	..	..	28
Total, all cows	2	58	135	194	278	232	134	67	16	7	3	1	..	1,127
<i>Season 1928-29.</i>														
Jersey .. .. .	..	11	73	139	172	194	127	56	29	8	3	4	1	817
Friesian .. .	2	20	80	111	139	101	58	27	5	2	1	..	..	546
Ayrshire .. .	..	..	3	28	39	27	4	5	..	..	..	..	..	106
Milking Shorthorn	..	10	15	33	29	13	4	3	..	..	..	1	..	108
Red Poll .. .	..	5	9	20	13	10	2	..	..	..	..	..	..	59
Total, all cows	2	46	180	331	392	345	195	91	34	10	4	5	1	1,636

Table 5 (next page) classifies average production according to age for the various breeds participating in the O.H.T., the figures for the preceding season being included for comparative purposes. In the light of the foregoing particulars this table reveals nothing unexpected. The production trend is more or less normal, and in the case of almost every breed the proportioning of the records among the classes is typical.

For the peak month of the past season there were 128 herds on Official Herd-test out of a total of 225 herds on Certificate-of-Record test; the largest number of cows under O.H.T. in any herd was 126, and the smallest number one cow. The average number of cows per herd was 11.5, a slight increase over the 1927-28 figure of 11. We should like to see this average higher still, being of the opinion that the fullest benefit cannot be obtained unless all sound and untested cows in the purebred herds are placed under Official Herd-test.

Table 5.—Average Production in Classes and Breeds for all O.H.T. Cows.

Class.	Season 1927-28.				Season 1928-29.			
	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.
<i>Jersey.</i>								
			lb.	lb.			lb.	lb.
Two-year-old and under	219	275	5,094.8	274.32	283	274	4,849.7	261.68
Three-year-old	117	273	5,914.5	322.34	172	276	5,691.2	311.31
Four-year-old	97	277	6,206.1	331.85	115	276	6,151.0	333.48
Mature	172	270	6,062.5	319.23	247	278	6,487.3	341.27
<i>Friesian.</i>								
Two-year-old and under	121	257	6,005.1	213.78	183	279	6,751.8	234.88
Three-year-old	73	261	7,586.2	260.87	106	275	8,055.2	278.84
Four-year-old	58	272	8,363.2	292.79	75	273	8,906.2	303.35
Mature	124	268	8,609.7	302.24	182	269	8,779.8	301.94
<i>Ayrshire.</i>								
Two-year-old and under	24	235	4,192.9	169.70	19	287	6,187.7	253.79
Three-year-old	15	258	6,061.5	234.57	20	282	6,765.4	259.98
Four-year-old	6	243	6,009.0	243.07	21	276	6,987.9	275.93
Mature	20	274	7,435.5	301.56	46	283	7,864.3	303.43
<i>Milking Shorthorn.</i>								
Two-year-old and under	25	252	4,589.2	191.39	22	268	4,610.6	187.84
Three-year-old	6	255	6,890.2	280.86	19	272	6,143.1	227.97
Four-year-old	4	257	6,961.1	284.56	13	262	6,714.4	263.21
Mature	18	252	6,359.5	250.56	54	263	7,336.9	280.67
<i>Red Poll.</i>								
Two-year-old and under	3	281	5,233.4	225.04	18	263	4,842.7	194.20
Three-year-old	8	280	5,372.3	230.51	8	267	5,766.9	226.29
Four-year-old	4	296	6,604.8	274.44	12	260	6,203.7	259.30
Mature	13	281	6,924.5	297.23	21	257	6,709.8	272.81

SPARTINA TOWNSENDII.

A VALUABLE GRASS FOR RECLAMATION OF TIDAL MUD-FLATS.

H. H. ALLAN, Systematic Botanist, Plant Research Station, Palmerston North.

1. Experiences in Great Britain and Continent of Europe.

"NEARLY sixty years ago a Gift from Heaven appeared on the salt marshes of Southampton Water—a grass which became known as *Spartina Townsendii*, and which has since spread aggressively along the muddy shores of both England and France." "In addition to being a botanical phenomenon of the first order, perhaps unique in the recorded history of vegetation, the spread of *Spartina* is raising economic problems which will have to be grappled with sooner or later. Though still in the phase of youth *Spartina* already occupies dozens of square miles of mud-flats in pure stands which continually get denser and denser. There seems little risk of error in asserting that in the future this area will expand to hundreds of thousands of miles. Subject to climatic limitations, wherever there is mud there will be *Spartina*. It is time for us to learn something about the properties of this amazing plant."

Flamboyant descriptions of plants that are to work wonders are a regularly occurring phenomenon, but the above two quotations from the pen of a sober botanist, Professor F. W. Oliver, F.R.S., of the University of London, sufficiently indicate that the possibilities of *Spartina* for New Zealand are well worthy of serious consideration. Indeed, considerable interest has already been aroused, and it would seem well to put before those concerned the present state of our knowledge on the subject. The first part of this article is based upon personal communications from, and the published papers of, various workers with the grass. I have especially to record my thanks for the help afforded me by Professor Oliver, Dr. O. Stapf, F.R.S., and the late Professor R. H. Yapp. The second part deals with the progress of tests with *Spartina* in New Zealand.

ORIGIN AND STATUS OF THE GRASS.

Spartina stricta, a rigid, low-growing, maritime grass, has been known on mud-flats in various parts of England and the Continent of Europe from very early times. *S. alterniflora*, a taller plant, made its appearance at Southampton Water and at the mouth of the Adour about 1829. This is an American species, and is supposed to have been brought over accidentally by shipping. *S. Townsendii* was found first at Southampton Water in 1870, and in 1910 it was reported from the French coast.

S. Townsendii was first recorded as a variety of *S. stricta*, but Stapf, after careful study, pronounced it to be distinct from that species; nor does it match any American form of that species. Stapf's view is that it is a natural hybrid between *S. alterniflora* and *S. stricta*. Its remarkable vigour of growth and its botanical characters support this view, as does the finding of a form near

Bayonne (*S. Neyrautii*) that is to all intents and purposes the same as *S. Townsendii*. On the other hand, if the plant be a hybrid, one would expect it to throw diverse progeny, yet the seedlings appear always to be of the usual *S. Townsendii* character, and to possess the same vigour of growth. Definite experimental and breeding tests have not so far been carried out.

LIFE-FORM AND HABITAT CONDITIONS.

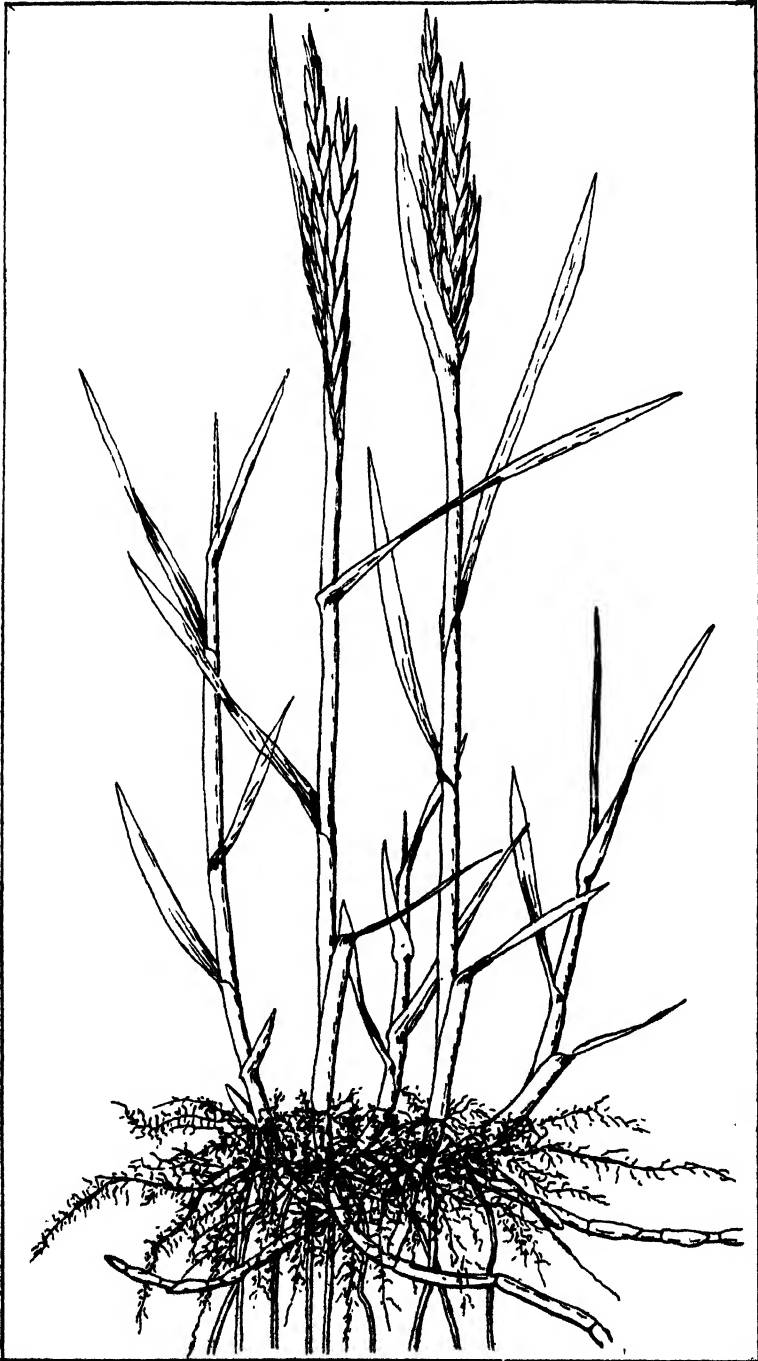
By "life-form" is meant the general habit of growth a plant exhibits in its natural habitat or growing-place. A single tuft when planted out on the mud spreads laterally by stout underground stems, and soon forms a more or less circular patch. Under favourable conditions such a patch may extend at the rate of from 2 ft. to 3 ft. per year from its centre in all directions. Adjacent tufts will thus unite and finally form continuous sheets. Growth is more vigorous on the outer margins of the patches, where the stems are free from competition one with another and grow taller. The patch thus tends to exhibit a saucer shape. There are two types of roots—long, anchoring, deeply descending roots, and short, branching, feeding roots that form a dense mass in the surface layer. The patches hold and collect mud, thus rising gradually in level, and the mud becomes firm and stable. The flowering shoots reach from 1 ft. to 4 ft. or even more, bearing from four to nine erect close-growing spikes densely crowded with flowers. Flowering is irregular in extent, and spread over a long period. Generally the plant is a rather shy seeder, but occasionally an excellent crop of seed is produced. Erosion of the margin of a patch sometimes detaches tufts, which may establish themselves elsewhere and assist in the spread.

Spartina does best on soft tidal mud-flats within about 3 ft. of the high-water mark of spring tides. It does not care for more than about six hours' submersion per tide. Just what degree of salinity is most favourable has not definitely been ascertained. The plant thus occupies successfully areas that otherwise are left bare of higher vegetation, being aided in this by its remarkably complete system of air-spaces.

OCCURRENCE IN ENGLAND, FRANCE, AND HOLLAND.

Since 1870 *S. Townsendii* has gradually spread east and west along the sheltered coast-line behind the Isle of Wight. At Poole Harbour, which it reached in 1899, the plant has spread in a most remarkable way into all the inlets and bays. It reached Pagham Harbour in 1918, and has established at Rye since 1922. It has also been purposely introduced into other muddy estuaries in Kent, Essex, Suffolk, Norfolk, and the Firth of Forth on the east coast, and into the Severn and Dovey on the west. Lately plantings have also been made in Cork Harbour.

In the river-estuaries at Bayonne and Fuenterrabia *S. stricta* and *S. alterniflora* both occur, and at the latter place *S. Neyrautii*, hardly if at all distinguishable from *S. Townsendii*, was discovered in 1895. *S. Townsendii* was noted on the coast of Brittany in 1906 at Réville and Carentan, and at Tancarville, head of the Seine estuary, in 1915. By 1922 it had reached Deauville and Havre. The "few tufts" at



SPARTINA TOWNSENDII.

[Drawing by V. D. Zotos.

Carentan of 1906 have now filled a more or less continuous block of some four square miles. In the Seine estuary there is now a great belt from Carentan to Havre. Of this Oliver says, "From this belt stretch out almost at right angles into the estuary numerous streamers of *Spartina* tussocks in open formation. . . . In a few years' time this phase will have passed, and this north bank of the Seine will be a continuous prairie of grass." On the higher levels of one salt-marsh area the *Spartina* appears to have been dominated and suppressed by *Glyceria maritima*, a grass of much less value.

Dr. J. P. Lotsy visited Poole Harbour to study the grass in 1923. As a result of his investigations and those of Mr. A. G. Verhoeven, maritime engineer in charge of reclamations in Zeeland, the Dutch Government decided to make large-scale experiments. In 1924 Mr. Verhoeven commenced operations, especially in the Scheldt area. These experiments are already providing a great deal of information.

ECONOMIC APPLICATIONS.

Navigation.—To quote from Oliver: "The danger to navigation inherent in reclamation is this: When parts of a tidal estuary are banked off and removed from tidal action, by so much is storage space for water diminished; and this amount will be lacking for scour at the ebb. The result is that channels become choked and navigation suffers." The effect of *Spartina* at Poole Harbour appears to have been: (1) In the first stage much mud is transferred to higher levels, with a widening and deepening of the channels; (2) with the increasing spread of *Spartina* the rate of addition of mud to higher levels wanes. The result is that the rate of flow slows down, and the tidal water occupies a lower level than before. Both effects tend to a lessening of the scouring-power at ebb, and the encumbering of the mouth with silt. On the other hand, *Spartina* may have value in binding the banks and confining water to definite channels. Before extensive planting of *Spartina* is undertaken the navigation aspect must be considered, if that aspect is likely to be of any importance.

Reclamation.—*Spartina* is unique in its ability to colonize soft, deep muds submerged at high tides. From its habit of growth and the resulting raising of the silt its power as a reclamer of such areas is very great. This is enhanced by its remarkable rapidity of growth. The experiences in Holland are worth noting. I quote from Oliver's "Vignettes from Holland": "These plantations have reached an impressive phase. The *Spartina* cuttings are mostly planted in the muds at 3-metre intervals, and have made three and sometimes four years' growth—such plants averaging 6 ft. to 7 ft. across. The most extensive of these plantations, covering about a square kilometre of mud, lie right across the Sloe, just south of the dam on which runs the railway from Flushing to the Continent of Europe. . . . The plants flower and seed freely by their second year, and self-sown seedlings can be detected. . . . These seedlings are found useful for extending the lines further out, and are reported to give better results than cuttings. This patch alone must contain something like 50,000 tufts—an enormous undertaking when it is borne in mind that on the less soft muds a man can plant 500 a day, whilst on the softest, into which he sinks deep, only 200. The Dutch workers

scorn the help of mud-boards and go barefoot. . . . What impresses Mr. Verhoeven is: (1) The sturdy way in which *Spartina* settles in to its work, establishing, expanding, and flowering freely; (2) that it can occupy at once soft, mobile, untamed muds; and (3) raise their level perhaps 6, 8, or more inches a year. If this promise is borne out, it means that ground treated with *Spartina* should be ready to polder (*i.e.*, bank in) at least ten years earlier than would otherwise be the case; as this is cumulative, it means a great deal in terms of the country's future. . . . After inspecting these convincing experiments, it is evident that a new era has opened for *Spartina*, and the world should have no cause to hesitate in utilizing it wherever ground, climate, and economic conditions are favourable."

The most suitable planting methods appear to be these: Cuttings should be inserted in a nick in the mud about 2 in. or 3 in. from the surface, and the nick closed by foot-pressure. The cuttings should be in rows parallel to the shore and not more than 3 ft. apart. An acre will need about five thousand cuttings. When seed is tried, each seed should be pressed into the mud deep enough to ensure its not being washed away. Where the surface is covered by mats of low forms of vegetation the seed may be pushed under this.

Raw Material for Paper.—Experiments have shown that *Spartina* will make a very fair quality of paper. However, the difficulty of harvesting clean mud-free material, the great labour involved, and other difficulties, may prevent its economic utilization for papermaking.

Stock-feed.—Oliver states: "No one who has lived on a farm, bordering, *e.g.*, on Poole Harbour, can have remained in doubt as to the value of *Spartina* in the feeding of stock. Horses, sheep, and cattle eat it with avidity, and habitually make their way on to the *Spartina* meadows almost before the tide has run off. Farmers speak well of it except that it gives an undesirable flavour to milk. As the grass remains standing on its roots throughout the winter till April, it forms a most convenient reserve feed that can be cut as required."

Knowles has recorded an interesting experiment on the composition and nutritive value of *Spartina*, carried out in Essex. Analyses revealed the following composition, to which are added those of meadow hay for comparison:—

	Freshly Cut <i>Spartina</i> . Per Cent.	Dry Matter of <i>Spartina</i> . Per Cent.	Dry Matter of Good Meadow Hay. Per Cent.
Moisture	77.90	..	..
Ether extract ..	0.61	2.76	2.92
Crude protein ..	2.88	13.04	11.32
Crude fibre	5.00	22.95	30.69
Nitrogen—free extractives ..	11.18	50.27	47.84
Ash	2.43	10.98	7.23

The mineral components, as percentages of the dry material, are:—

	<i>Spartina</i> .	Pasture.
Silica	2.29	1.521
Silica-free ash ..	8.69	4.663
Chlorine	2.72	0.561
Phosphoric acid ..	0.782	0.516
Potash	1.82	2.394
Magnesia	0.967	..
Calcium oxide ..	0.45	0.464
Soda	Not determined	0.151
Total ash	10.98	6.184

These figures show that the dried sample of *Spartina* was of somewhat similar chemical composition to good or very good meadow hay. "The mineral composition of the plant is, however, somewhat unusual, as might be expected from its habit of growth."

For a feeding trial two samples each of about 10 cwt. of the dried plant were obtained from Poole Harbour. "The first sample was cut on the 18th July, and spread out on a drier piece of land within about 40 yards of the sea, where it was roughly dried for a period of a week of rainless but dull weather, put into bags, and despatched on an eight-day railway journey. On arrival it was spread out in bright sunshine for three days to 'make' thoroughly. The dry material was then chaffed, and the chaff spread out on a clean floor of an airy room for about a month, with frequent turning and mixing to ensure an even moisture content throughout. It is noteworthy that, even after this length of time and in the chaffed condition, the sample contained about 18½ per cent. of moisture. In the green condition, and during the haymaking process, there was a decided smell of the sea, and to a lesser degree also of seaweed. This smell persisted in the dried hay."

A second cut was taken from the same spot seven weeks afterwards. "Perhaps the most astonishing thing about this second cut, or aftermath, was the extreme vigour of growth in so short a period, the young shoots being from 18 in. to 20 in. in length, and the yield apparently as heavy as had been obtained at the previous cutting."

The sample of hay, for the second experiment, was cut on the 28th August, and, roughly made at Poole during eight days of rainless weather, reached Chelmsford three days later in a semi-green condition. The weather now experienced was so bad that the hay-making could not proceed, and the partly dried grass was kept under cover for about a month, when it was chaffed and spread out on the floor of an out-building for about a week, and then on the floor of a warm and airy room for a further fortnight."

The analyses of these samples showed:—

				First Sample.	Second Sample.
Ether extract .. .. .	..	..	..	1.63	2.54
Crude protein .. .. .	..	..	..	7.90	13.04
Crude fibre .. .. .	..	..	..	30.61	29.65
Nitrogen-free extractives .. .. .	..	..	..	49.85	43.00
Ash .. .. .	..	..	..	10.01	11.77

The feeding trials aimed at determining the digestibility of the animal nutrients in the hay. Two twelve-month-old Border Leicester-Suffolk wether sheep were used, and the usual precautions taken. "It was found that the sheep readily ate green *Spartina* on first acquaintance with it, and that no difficulty was experienced in getting them to eat moderate-quality *Spartina* hay three days after their arrival on the farm." The percentages digested of the nutrients of the two samples are shown as follows:—

				First Sample.	Second Sample.
Ether extract .. .. .	..	..	..	40.5	39.0
Crude protein .. .. .	..	..	..	39.3	45.7
Crude fibre .. .. .	..	..	..	62.6	66.0
Nitrogen-free extractives .. .. .	..	..	..	48.5	46.0

In the first trial the animals were nine days on the *Spartina* before the nine-day experimental period was commenced. They were then

at liberty for six weeks. During the last month of this they received nothing but *Spartina* hay, and were then subject, in their stalls, to a fixed ration for four days, followed by an experimental period of eleven days.

Knowles makes the following conclusions: "Poor *Spartina* hay is similar in composition, apart from mineral matter, to poor meadow hay, and is fully as digestible. . . . If very indifferently made *Spartina* hay has a nutritive value equal to that of poor meadow hay, it does not seem unreasonable to suppose that *Spartina* could be equal to good meadow-hay if favourable haymaking conditions could be obtained." The sheep maintained perfect health, and showed no signs of constipation, even when they were closely confined and fed solely on the hay. "Alternatively it might be worth while to consider making *Spartina* silage, particularly as it would probably be some years before the land newly colonized by the plant would be sufficiently consolidated to allow of grazing by heavy stock. *Spartina* silage might conceivably be better suited for stock than either the green plant or the hay, as a good deal of the salt would probably be expelled during ensiling."

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Fuller details of the topics discussed above will be found in the following publications:—

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(To be continued.)

Direct Sowing for Tree Plantations.—Experiments on a comparatively large scale have been made by the State Forest Service for a number of years to test the possibility of establishing plantations by direct seeding, but the results so far have not been very successful, except in certain pumice areas where the soil conditions are particularly favourable.

MANURIAL TOP-DRESSING OF LUCERNE.

EXPERIMENTS IN CENTRAL OTAGO.

R. B. TENNENT, Fields Superintendent, Dunedin, and A. S. DUFF, Instructor in Agriculture, Alexandra.

IN the spring of 1928 seven lucerne top-dressing experiments were laid down on a co-operative basis with farmers in Central Otago—six on irrigated and one on non-irrigated country. Although, generally speaking, Central Otago soils are of high fertility it was thought that economic increases in yields would be obtained from the application of suitable fertilizers.

As a result of observations made while in California one of the writers was of opinion that fertilizers containing sulphur or sulphur compounds would have a marked effect in increasing the growth of lucerne, particularly on those soils slightly inclined to "alkali" troubles, and this factor was given chief consideration in selecting the types of fertilizers for trial. Experiments in America have conclusively shown that where sulphur compounds are applied to crops growing on alkali soil the toxic effect of the alkali is considerably diminished, and that the application of such fertilizers reflects in a much healthier and more productive crop. Although in Central Otago there do not exist to any extent "alkali" soils typical of those obtaining in other parts of the world, there are, however, in many localities soils with alkali characteristics, and in the case of those it was thought that the application of suitable fertilizers would play an important part.

Quite apart from this aspect of the case it has been shown by independent investigators that plants utilize more sulphur than has been generally supposed. Mr. B. W. Doak, of the Cawthron Institute, who has been working on the question of sulphur in relation to lucerne, has obtained significant increases in yield from the application of sulphur, sulphur compounds, or sulphur-containing fertilizers, and analysis of lucerne-plants obtained from the undermentioned experimental plots showed an increase over the control in sulphur content on those plots top-dressed with sulphur-containing fertilizers.

Table 1.

Manurial Treatment.	Total Green Weight Yield per Acre off Second, Third, and Fourth Cuts.	Sulphur Content.
	Tons.	Per Cent.
Control (no manure)	10.3	0.37
Superphosphate 44-46 per cent., 3 cwt. per acre	15.4	0.44
White Island No. 1 Product, 3 cwt. per acre..	16.5	0.45
Superphosphate 44-46 per cent., 3 cwt., plus White Island No. 1 Product, 3 cwt. per acre	16.8	0.53

NOTE.—The analyses for sulphur content were carried out by the Cawthron Institute.

A typical example of yield increases, better colour of herbage, and corresponding increases in sulphur content from the application of sulphur-containing substances, taken from one of the experiments carried out in Central Otago—that on the property of Mr. R. T. Kinaston, Roxburgh—is given in Table 1.

PLAN OF EXPERIMENTS.

The experiments were designed to ascertain the effects of superphosphate and White Island No. 1 Product, each used individually at the rate of 3 cwt. per acre, and in conjunction with equal quantities at the total rate of 6 cwt. per acre. The plots were laid down on the strip method, control strips without fertilizers being utilized to offset any differences which might result. Altogether there were seven replications of each treatment and eight control strips, each strip being 4 chains long. At harvesting, weighings—of green material in each case—were made of strips $\frac{1}{2}$ chain by 4 ft. 6 in., this resulting in fifty-six weighings being made of each treatment, or a total of 224 weighings from all treatments. The experiments therefore afforded sufficient weighings to allow a statistical examination to be carried out. In all cases the first cut of lucerne was not taken, and this is to be regarded as unfortunate, inasmuch as some striking differences were visible to the eye.

It is of interest to record that White Island Product No. 1 was used in these trials from the point of view that it contains a fair proportion of sulphur. No analysis was made of the actual material applied to the plot in question, but presuming it was the same grade as that used by Mr. Doak in his experiments its sulphur content would be in the vicinity of 21.7 per cent. plus 7.89 per cent. sulphur trioxide. (*N.Z. Journal of Science and Technology*, Vol. xi, No. 1, pp. 25-29, 1929.)

RESULTS OF EXPERIMENTS.

(1) R. T. Kinaston, Roxburgh.

This experiment, conducted on an irrigated five-year-old crop, was laid down on 16th August, 1928. The soil consisted of a good loam overlying a sandy loam and gravel subsoil. The first cut was not weighed, but three subsequent cuts were weighed on the dates given in the following table:—

Table 2.

Treatment.	Second Cut, 4/1/29.		Third Cut, 15/2/29.		Fourth Cut, 4/4/29.		Total Yield per Acre (Three Cuts).
	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Control (no manure) ..	3.5	..	4.6	..	2.2	..	10.3
Superphosphate ..	5.6	2.1	5.8	1.2	4.0	1.8	15.4
White Island Product	5.7	2.2	6.1	1.5	4.7	2.5	16.5
Superphosphate plus	5.9	2.4	6.0	1.4	4.9	2.7	16.8
White Island Product							

All the increases recorded are significantly better than the control-plot yields. It was quite apparent that the treated plots were in every way superior, this being reflected in better growth and colour. There was little visual difference between the treated plots, although those treated with super plus White Island Product appeared to have the richest appearance and most luxuriant growth.

(2) *M. P. McGinnis, Earnscliffe.*

This experiment was conducted on a particularly poor soil-type, chiefly composed of gravel and silt with a gravel subsoil. The lucerne-field was three years old, and, being grown under the border method of irrigation, lent itself admirably to even watering. The treatments were applied on 13th August. The first cut was not weighed, although most marked differences were visually observed. Three cuts were subsequently made and weighed, with the following results:—

Table 3.

Treatment.	Second Cut, 1/1/29.		Third Cut, 14/2/29.		Fourth Cut, 18/4/29.		Total Yield per Acre (Three Cuts).
	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Control (no manure) ..	0.7	..	0.7	..	0.6	..	2.0
Superphosphate ..	2.3	1.6	1.3	0.6	1.2	0.6	4.8
White Island Product	1.9	1.2	1.1	0.4	1.2	0.6	4.2
Superphosphate plus White Island Pro- duct	2.6	1.9	1.5	0.8	1.5	0.9	5.6

In this experiment the yields in the second and fourth cuts are averages of fifty-six plots, while the yields in the third cut are averages of forty-eight plots. All increases over control plots are significant. The effect of all treatments was most marked. The control strips were weak and sickly, and in so far as their crop-producing capabilities were concerned could be regarded as a failure. There is thus every indication that by the application of fertilizers in the early growing stages of the crop, success in lucerne-growing can be attained on soils of this nature, which exist in considerable areas in Central Otago.

(3) *W. Kloogh, Springvale.*

The land upon which this irrigated stand of lucerne is growing is of a light nature, being largely composed of gravel intermixed with a silty soil. At the time the experiment was laid down—4th August—the lucerne stand was five years old. The first and third cuts were not weighed, the latter being too patchy for true results. The reason for this was scanty and uneven irrigation having taken place owing to a break occurring in the main race at the time when this third crop ought to have been thoroughly irrigated. Results are shown in Table 4.

Table 4.

Treatment.	Second Cut, 3/1/29.		Fourth Cut, 8/4/29.		Total Yield per Acre (Two Cuts).
	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	
	Tons.	Tons.	Tons.	Tons.	Tons.
Control	6.70	..	4.10	..	10.80
Superphosphate	6.93	0.23	4.20	0.10	11.13
White Island Product ..	6.98	0.28	4.30	0.20	11.18
Superphosphate plus White Island Product	7.00	0.30	4.30	0.20	11.30

In the first cut super plus White Island Product showed the best growth, while super and White Island Product alone were definitely superior to no manure. At the time of cutting the second crop no difference could be seen, except that the control plots were lighter in colour than the treated plots. The increased weights from the super treatments are not statistically significant, but those obtained from White Island Product alone and in conjunction with super are significant. All yields are averages of fifty-six weighings.

(4) *W. Noble, Galloway.*

This experiment was carried out on a four-year-old irrigated lucerne stand growing on good mica-schist loam with a gravel subsoil. The treatments were applied on 2nd August, and only two cuts were weighed. Details are as follows:—

Table 5.

Treatment.	Third Cut, 29/1/29.		Fourth Cut, 26/3/29.		Total Yield per Acre (Two Cuts).
	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	
	Tons.	Tons.	Tons.	Tons.	Tons.
Control (no manure) ..	6.5	..	6.5	..	13.0
Superphosphate	6.9	0.4	6.6	0.1	13.5
White Island Product ..	6.8	0.3	6.6	0.1	13.4
Superphosphate plus White Island Product	6.8	0.3	6.5	..	13.3

In the earlier cuts (not weighed) a slight superiority of the treatments over the control plots was evident, but at the time of the third cutting the only difference discernible was in the colour, which was better on all treated plots. Prior to the fourth cut no difference between treated plots was definitely distinguishable. In the weighings from the third cut the differences of the treated plots from control plots are significant, but this is not so in the weighings relating to the fourth cut. All yields are averages of fifty-six weighings.

(5) *Messrs. Towan Bros., Cromwell.*

Sown down on a good loam soil with a gravel subsoil, this irrigated five-year-old lucerne stand was in good condition at the date of

top-dressing on 8th August. Only the second cut was weighed—on 2nd February—all subsequent growths being grazed. Results were as under :—

Table 6.

Treatment.	Second Cut, 2/2/29. Yield per Acre.		Increase over Control.	
	Tons.		Tons.	
Control (no manure)	8.1		..	
Superphosphate	8.9		0.8	
White Island Product	9.1		1.0	
Superphosphate plus White Island Product	9.3		1.2	

All treatments were much superior to the control plots, both in growth and colour. The increases over the unmanured plots were significant. All yields are averages of fifty-six weighings.

(6) *J. Weaver, Roxburgh.*

This particular experiment was carried out on a non-irrigated stand, the manures being sown on 17th August. The soil consists of a medium loam overlying a typical gravel subsoil, the age of the crop at the date of top-dressing being three years. Dry weather during the growing-period of the third crop, and the fact that some stock broke into the plot in the early stages of its growth, resulted in low yields, as shown in the following table:—

Table 7.

Treatment.	Second Cut, 5/1/29.		Third Cut, 16/2/29		Total Yield (Two Cuts).
	Yield per Acre.	Increase over Control.	Yield per Acre.	Increase over Control.	
	Tons.	Tons.	Tons.	Tons.	Tons.
Control (no manure) ..	5.2	..	1.9	..	7.1
Superphosphate ..	6.0	0.8	2.1	0.2	8.1
White Island Product ..	5.8	0.6	2.1	0.2	7.9
Superphosphate plus White Island Product	6.1	0.9	2.2	0.3	8.3

The increases recorded are all significant, although the superiority of super plus White Island Product over super is not significant. All manured plots were superior in growth and colour to the untreated plots, the order of superiority being as indicated by the yields. The differences were difficult to detect in the third cut owing to the adverse conditions.

GENERAL CONCLUSIONS: THE EFFECT OF SULPHUR.

From the foregoing experiments, laid down under diverse conditions and under varying methods of irrigation, it is evident that the practice of manuring lucerne in Central Otago must in time, and with benefit, become more general than is at present the case. The evidence afforded points to the fact that superphosphate of the 44-46 per cent.

grade can be regarded as a suitable commercial fertilizer to use, and further indicates that materials, such as White Island Product, containing a fair percentage of sulphur are highly valuable in stimulating the growth of lucerne. The writers are not prepared to discuss the question as to whether the increases recorded from White Island Product are due to straight-out sulphur assimilation—which evidently occurs—or whether they are indirectly due to the effect of sulphur in mitigating the effect of alkali and liberating unavailable phosphates in the soil. Probably all these factors combined have a direct bearing on the results recorded.

These experiments will be carried on for a period of years to see how long the beneficial effects will last, and to ascertain when the various top-dressing treatments require repetition. From the evidence there appears to be every justification in expecting better results where White Island Product, with its comparatively low percentage of sulphur, is replaced by straight-out applications of finely ground pure sulphur. Accordingly experiments are now in hand with the object of obtaining definite data on this point, and the probable beneficial effect of gypsum will be investigated at the same time. It will also in course of time be ascertained from all these experiments whether manuring affects the root-development of lucerne.

The writers wish to place on record their keen appreciation of the able co-operation of the several farmers on whose properties the experiments were carried out.

BOVINE PARTURIENT ECLAMPSIA.

MR. J. LYONS, M.R.C.V.S., Director of the Live-stock Division, makes the following remarks on this subject in his annual report for 1928-29:—

This disease is still in evidence in a great many dairying districts throughout the country, and considerable loss has been caused thereby. The origin of the disease is somewhat mysterious, and presents a difficult problem to the research workers. Strictly speaking, there is no organic disease. On post-mortem examination nothing abnormal can be observed, and the only assumption that can be arrived at is that the trouble is an absorption of toxins from the intestines or womb, or that it is a lack of some essential element in the system at this particular period. This aspect of the question is being followed up. When making investigation into this complaint one is struck with its similarity to milk-fever. Both these troubles occur in the richer class of country where animals are being well cared for, and many of the symptoms are common to both. So much is this the case that I am satisfied that many cases of milk-fever are mistaken for eclampsia, and on this account treatment is not applied, or, if so, only in a perfunctory manner, as there is a preconceived idea that treatment for the latter trouble is useless, and that fatal results will follow in spite of any treatment that may be applied. In these circumstances I am strongly of opinion that when a cow goes down after calving the customary treatment for milk-fever should be applied in every case. It can do no harm, and in many cases will be the means of restoring the cow to her normal condition. If this treatment is properly carried out (the udder should be inflated until it is tense and hard to the feel), and care is taken to see that the animal is kept in her natural position afterwards, I feel sure that mortality among our dairy stock at this season would be considerably lessened.

NORTHERN WAIROA DEMONSTRATION FARM.

NOTES ON OPERATIONS IN 1928-29 SEASON.

C. J. HAMBLYN, B.Agr., Instructor in Agriculture, Whangarei.

IN North Auckland the winter of 1928 was characterized by a heavy rainfall, with, however, frequent periods of sunny weather. The early spring rainfall was below the average, but there was plenty of moisture until well into January, when a dry spell was experienced. Good rains from the middle of March onwards provided for an abundant autumn growth.

With continuation of top-dressing, improved drainage, and frequent tripod harrowing the pastures on the Demonstration Farm at Dargaville show a further marked improvement, while the area in permanent grass has been extended. Pennyroyal, buttercup, and docks have practically disappeared from all the older pastures, and rushes are much less troublesome. Basic slag is being used as the main phosphatic fertilizer for top-dressing, and is giving good results. In order to demonstrate that with the ordinary annual application of from 3 cwt. to 4 cwt. of phosphate per annum farmers of the district were not likely to be wasting fertilizer through an oversupply; one paddock was given 6 cwt. of basic slag per acre. This paddock was outstanding throughout the season, both in regard to colour and density of the sward, and was always preferred by the stock.

The area in crops was reduced to 3 acres of soft turnips, which were fed out from the end of January to the middle of April. Soft turnips as supplementary feeding for this period are being replaced by silage made from excess pasture growth in November and December. With the extension of the area under pasture and the adoption of rotational grazing the position in regard to the provision of adequate supplies of hay and silage is gradually being improved. Three paddocks cut for hay, including a 6-acre temporary pasture of Italian rye-grass and red clover, yielded about 30 tons of winter feed, and one paddock made into silage provided 20 tons. Half of the latter was not required during the past winter, and is being kept for supplementary feed from next January on.

The butterfat production of the farm was again affected to a marked extent by late calving owing to temporary sterility, and by an outbreak of mammitis. An increase of 690 lb. butterfat over the production for the previous season was due mainly to improved pastures and better pasture management and utilization. The position with regard to late calving is gradually improving with careful herd-management, and mammitis has decreased.

MOLE DRAINAGE.

During the past two seasons several fields on the farm have been mole-drained in order to study the effectiveness of this type of drainage under the conditions obtaining on the heavy, flat alluvial land in the Northern Wairoa district. The large area of flat alluvial land, about 120,000 acres in extent, stretching from Kirikopuni to Ruawai has

been built up of fine clayey material deposited in the tidal reaches of the Northern Wairoa River. This land is difficult to drain, and is subject to bad poaching by stock when wet. There are naturally many variations in texture, according to the proportion of very fine clay in the soil and variation in the depth of black soil overlying the clay subsoil—indicated by different types of natural cover, such as flax and manuka, raupo, kahikatea, puriri, and cabbage-tree—and in the main the drainage problem is closely related to the nearness to the surface of the clay subsoil and to the texture of the clay. Efficient drainage is definitely the first and chief requirement in the successful establishment of pastures on these soils.

By means of Drainage Boards and drainage areas more or less effective systems of main-outlet drains have been put in as a basis for individual farm drainage by means of open drains. Where such farm drains were put in before there was much heavy stocking of the land, and where they are deep and the water gets away rapidly to the outlets, a complete system of them, together with small paddocks, is fairly effective in keeping the land dry in the winter, but there are always portions of the paddocks from which the surface water is not removed quickly enough to allow of stocking. Deep and numerous open drains, however, are objectionable in that there is definite over-drainage in the summer, and the cleaning and maintenance is difficult and costly.

Thorough drainage—which means the maintaining of the water-level sufficiently below the surface to rapidly remove the extremely harmful excess water resulting from heavy winter rains, at the same time keeping the level of the water within reach of the roots of pasture plants as long as possible during dry weather—can be secured only by combining a system of comparatively shallow open drains leading into an effective outlet drain to carry off the flood waters, with a system of underground drainage to remove the water rapidly from the surface of each paddock and lead it out into the open drains. With such a system of drainage pastures are earlier, fertilizers and harrowing more effective, there is no poaching of the surface, and weeds such as pennyroyal, buttercup, and rushes are suppressed; also the stock are comparatively dry underfoot even in wet weather, while the effect of droughts in drying out the pastures is considerably reduced.

For thorough drainage tiles are undoubtedly the best, while very effective drains can be constructed by using manuka fascines or timber slabs to make a passage-way for the water at the bottom of the drains after they are filled in. All these methods, although fairly permanent if well carried out, are slow and require a great deal of labour, and, in the case of tiles, the use of expensive material. It is estimated that in the Northern Wairoa district a system of tile drains 1 chain apart costs on an average from £7 10s. to £10 per acre. In view of the fact that an effective system of mole drains 9 ft. to 11 ft. apart can be put in, where conditions are suitable, for from 7s. to 10s. per acre, experimental work with this method has been carried out on the Demonstration Farm.

The best type of mole plough consists of a beam of angle-iron from 6 ft. to 8 ft. long with a skid at the front and a heavy blade fitted at



FIG. 1. MOLE PLOUGH ENTERING SIDE OF OPEN DRAIN AT THE DEMONSTRATION FARM.

Note adjustable bar from middle of beam to top of blade to regulate depth.



FIG 2. PLOUGH IN ACTION, TRACTOR-DRAWN.

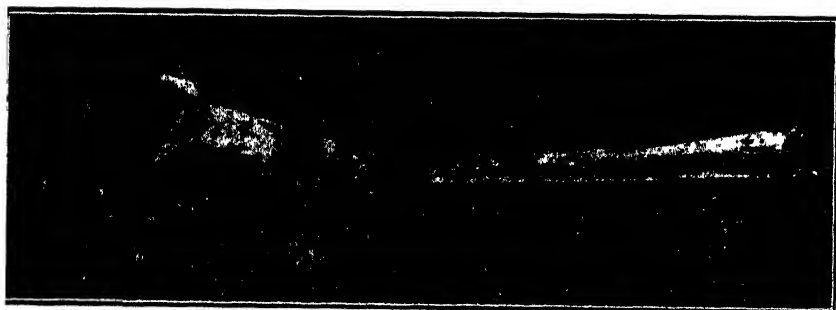


FIG. 3. PLOUGH EMERGED FROM GROUND BY SELF-LIFTING ACTION.
At end of paddock the bar is tripped and plough lifts.

the back, and with the torpedo and ball or cone attached to the foot of the blade. The blade is adjustable to allow for alterations in depth. This type of plough has superseded the older heavy types of sledge or wheeled mole ploughs, and has the advantage of being easily handled; with the skid at the front of the beam and a long chain, any slight inequalities in the ground, such as lumps and hollows, do not affect the general level at which the mole is drawn. Six to eight horses or a tractor are necessary to draw the plough through the stiffer soils.

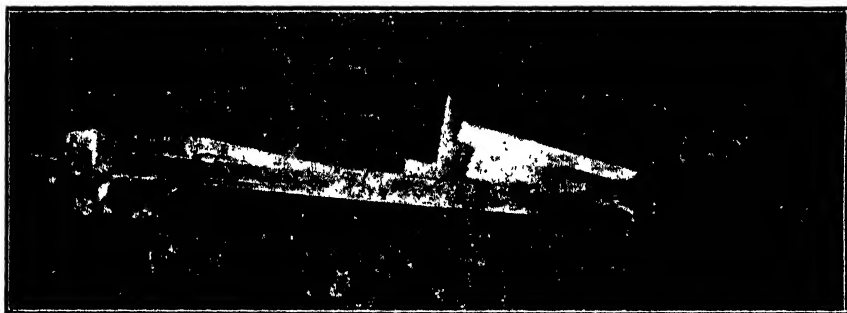


FIG. 4. PLOUGH IN TRANSPORT POSITION, RETURNING TO OPEN DRAIN.

Note spring hitch near head of plough—very necessary where occasional stumps occur.



FIG. 5. PLOUGH SET UP TO ENTER GROUND FROM SURFACE.

Here the implement is about to draw mole-drains across a hollow where later a covered drain will be made. Mole enters ground to required depth after being pulled a few feet.

For successful mole-draining there must be a fall, however slight, to the outlet drain from which the moles are to commence, and the land must have a suitable clay subsoil in which the mole is to be made, and be fairly free from underground stumps and logs or other obstructions. A fall can be secured where necessary by gradually altering the depth of the mole. The plough being set at the required depth, the blade is placed in the open outlet drain and the plough drawn to the far side of the field. On arrival at the end of the mole drain the working of a trip-lever brings the plough out of the ground.

The plough is then brought back to the outlet drain, and set in again 9 ft. to 11 ft. from the opening of the last mole drain.

Where there is no suitable open drain for an outlet, but a definite hollow occurs through the field, the moles can be made to cross the hollow by setting the plough up at one side of the paddock, drawing it across the depression, and lifting it at the other. With a plough that will enter the ground from the surface and is self-lifting this is easy to do. An open drain is then made crossing the moles, and this can be made into a covered drain to provide an outlet for the moles. Where the outlet of the mole drains is into an open drain the sides of which tend to crumble or become overgrown, a 2 in. or 2½ in. tile should be inserted in the end of each mole and allowed to project slightly into the open drain. This will prevent one of the chief difficulties of mole drainage—the gradual blockage of the outlets.

The best depth at which to draw the moles depends on the type of subsoil, but an average of from 16 in. to 18 in. is recommended, and shallower where the subsoil is very stiff. A mole of 2½ in. diameter is quite effective in most soils, and the draught is easier than for bigger moles, which have little advantage. As regards the distance apart of the mole drains, this again depends on the texture of the subsoil, the general average being from 9 ft. to 11 ft. on fairly stiff land, and wider where the soil is freer. The stiffer and more sticky the subsoil the longer will the moles last, while they are practically useless on free silts or sandy soils.

The results of mole drainage on the Demonstration Farm are promising, in that parts of paddocks, and in places whole paddocks, where heavy stocking during the winter resulted in bad poaching, were kept quite dry, with a consequent rapid thickening of the pasture sward and improvement in growth. In conjunction with the present systems of open drains, a great deal of pasture-land on farms in the Northern Wairoa could be efficiently drained by the mole plough, the use of which, however, in some cases is limited by the presence of roots and logs in the ground.

PASTURE EXPERIMENTAL WORK.

With further subdivision on the farm, a system of rotational grazing was put into operation during the season. A good supply of hay and soft turnips for late autumn and winter feeding allowed for the closing of 12 acres of grass at the end of May to provide an early bite for the first calvers, while a paddock top-dressed in July with 1 cwt. of sulphate of ammonia per acre gave useful grazing at the end of August, by which time the rotation was in full swing. As already mentioned, soft turnips are now being replaced by silage. A more intensive system of grazing is gradually being developed.

Two 3-acre paddocks—both of which had been phosphated—were used in a nitrogen top-dressing experiment. The application of 1 cwt. of sulphate of ammonia per acre in July to one of the paddocks gave a strong dark-green growth, which was ready for grazing two weeks earlier than the pasture of the adjoining paddock which did not have the nitrogen dressing. Of three later dressings with 1 cwt. of sulphate of ammonia, applied on 18th October, 22nd December, and

18th March last respectively, the latter was the only one to show an advantage as regards quickness and type of pasture-growth.

A comprehensive set of observational trials with various types of fertilizers was put down on three representative pastures in June last. These fertilizers include superphosphate, basic slag, North African phosphate, sulphate of ammonia, 30 per cent. potash salts, Diammonphos, and Nitrophoska, and include various combinations of these manures with and without lime. The plots will be continued over a number of years, the idea being that from continuous observation under normal grazing-conditions indications will be given by the plots as a guide to general top-dressing.

MISCELLANEOUS.

A start has been made with the provision of shelter-belts and shade clumps, this work having been delayed until the drains and fence-lines on the farm were definitely fixed. For north-and-south belts on the flats Bentham's cypress is being used in preference to Lawson's cypress, as being more suited to clay soils. The east-and-west belts are being planted with pampas-grass, which thrives along the drain-sides and does not shade the paddocks, but gives complete shelter from cold winds, at the same time eliminating a great deal of drain-cleaning and the crumbling of the sides of drains. For shade clumps weeping-willows are planted where springs occur, and eucalypts in odd corners.

Several well-attended field-days were held during the year in connection with rotational grazing, ensilage-making, and mole drainage.

Moisture and Protein Tests of Wheat.—In the course of a report on the past year's operations of the Wheat Research Institute, the Director (Dr. F. W. Hilgendorf) states: "Good progress has been made with moisture and protein tests. Owing to an extremely favourable harvesting season, it was possible to use the combine thresher in a number of Canterbury crops. Tests of this grain compared very favourably in regard to their moisture content with others made with grain secured from threshing-mills, but, on account of the exceptionally good weather prevailing, these results must be accepted with caution. In the protein survey very wide divergences in the protein content have been observed; and it has been found that in some instances a variety such as Tuscan, which is usually considered as being low in protein, is capable of approximating even Pearl in this respect. It is premature yet to base any conclusions on the work already completed, but the preliminary investigations indicate that systematic work on these lines will be productive of real economic advantage to the wheat industry."

Lice-infested Sheep.—Referring to this matter in his annual report for 1928-29, the Director of the Live-stock Division (Mr. J. Lyons) states: "Taking the position right through the Dominion as a whole there has been a slight improvement. However, there are still far too many sheep affected with lice being exposed in the saleyards. In the Auckland district there has been an increase in the number noted. To some extent this may have been caused by the lack of water which was in evidence during the dipping-period. The chief offenders are those on small farms carrying a comparatively small number of sheep as a side-line. I would again draw the attention of all owners to the fact that when sheep affected with lice are found in the saleyards the provisions of the Act will be enforced in all cases."

BOYS AND GIRLS' AGRICULTURAL CLUBS.

TARANAKI AND WELLINGTON DISTRICT COMPETITIONS, SEASON 1928-29.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

THE year 1928-29 recorded another very successful season in the boys and girls' agricultural club work, with a further increase in entries and an extension in the area covered, so far as the Taranaki and Wellington Provincial Districts are concerned. Till the previous season the work was confined to North and South Taranaki and the Wanganui and Feilding localities chiefly, but during the past year there has been additional club activity in the Taihape, Hunterville, and Wairarapa districts. Over all of these districts the total number of competitors, including both crop-growing and calf-rearing, was in the vicinity of 1,500. Competitions were on lines similar to those of previous seasons—that is, crop-growing in all districts, with calf-rearing in both North and South Taranaki and at Waverley.

CALF-REARING.

The number of calves judged in Taranaki during the past three seasons is as follows:—

			1926-27.	1927-28.	1928-29.
North Taranaki	..	..	117	154	215
South Taranaki	..	..	283	344	311

The group in the Waverley district embraces just the Waverley and surrounding schools, and is conducted by the local branch of the Farmers' Union.

Further improvement in the condition of the calves brought forward for judging was noted, although, as is only to be expected at this stage after several seasons' work, the improvement is not so marked as it was during the first season or so. The actual handling of the calves leaves much to be desired in some districts, and competitors would be well advised to pay more attention to this phase of the competition. Judging was again carried out on lines similar to those of previous seasons, the first judging being done at the respective schools and the winning animals then being brought forward to a selected centre for championship judging. The two classes for "light" (Jersey-Ayrshire) and "heavy" (Shorthorn-Friesian) breeds were adhered to, as in the past.

Judging was carried out during the latter part of November and early December, 1928. There were two distinct competitions, one for dairying condition or rearing and the other for type. In the condition competition the judges are asked to avoid awarding prizes to animals carrying undue superfluous flesh, but to interpret condition as meaning a well-reared, bright, healthy calf in what one would term milking condition. The judges were farmers selected for their judging ability as well as having that desired quality of demonstrating to the competitors what they should strive for.

Advantage was taken of the championship judging in North Taranaki to hold a general field-day for the competitors. Besides the actual



FIG. 1 TRANSPORT OF PARTY OF COMPETITORS AND THEIR CALVES BY MOTOR-LORRY TO CHAMPIONSHIP JUDGING CENTRE AT ELTHAM, TARANAKI.



FIG. 2. SOME CALF-CLUB COMPETITORS AND THEIR ENTRIES AT THE CHAMPIONSHIP JUDGING, ELTHAM.

judging of the calves for championship points, demonstrations were given on various breeds, and addresses delivered on calf-rearing and similar subjects, while a cow-judging competition was also conducted.

With a view to continuity the competitors are encouraged to bring animals previously judged for further judging, and during the season a large number of animals, ranging from yearlings to four-year-olds, were presented in this way.

In North Taranaki the championship for the Jersey-Ayrshire class was won by Muriel Schreiber, Waitui, and in the Friesian-Shorthorn class the championship went to Maisie Rea, Omata. The champion dairy-type Jersey-Ayrshire heifer was reared by Leslie Hodson, Tikorangi, while the corresponding championship in the Friesian-Shorthorn class went to Eileen O'Byrne, Egmont Village. In South Taranaki the championship for condition in the Jersey-Ayrshire class was won by Norma Walker, Okaiawa, while Gladys Taylor, Fraser Road, won in the Friesian-Shorthorn class. The dairy-type championship in the Jersey-Ayrshire class in this district was won by K. Laird, Mata, and that for the Friesian-Shorthorn class by Helen Nicholls, Otakeho.

CROP-GROWING.

The entries judged in the various districts were as follows: North Taranaki, 154; South Taranaki, 117; Wanganui, 138; Feilding, 204; Wairarapa, 126; Taihape, 65; Marton-Hunterville, 94.

The following crops were grown: North Taranaki, mangels and chou moellier; South Taranaki, mangels and carrots; Wanganui, mangels and carrots; Feilding, mangels and maize; Wairarapa, mangels; Taihape, mangels and carrots; Marton-Hunterville, mangels and carrots.

Seasonal conditions were fairly good for cropping, and some very fine yields were recorded. In North Taranaki two varieties of mangels were again grown, and this added interest to the competition, besides being a valuable factor in determining the best varieties to grow in the different districts. The varieties grown were Prizewinner and Red Intermediate.

It is pleasing to note that the number of crops dropping out of the competitions each season is gradually being reduced, although there is still ample room for improvement in this respect. Sowing of the seed too deep is responsible for a number of initial failures, while pests also take toll of the crops. The greatest factor in the elimination of entries is through stock breaking into the plot and destroying it. Fortunately, however, the number of failures from sheer neglect is small.

The outstanding success of the year in the districts under review was the crop of mangels grown by George Loving, of Huinga, which weighed out at the rate of 181 tons 5 cwt. per acre, and just missed winning the Stuart Wilson Cup for the 1928-29 season. The Barres Stryno mangel grown in South Taranaki this season was very successful, the variety, generally speaking, yielding very well. It is a good show mangel, and drew forth much favourable comment at the various shows where displays were made.

The results for the championship and the average yields were as follows:—

North Taranaki :—

Mangels :				Tons cwt.	
1st, V. Penwarden, Tataraimaka	..	..	..	119	4
2nd, G. Beaven, Tikorangi	..	..	..	112	0
3rd, B. Beaven, Tikorangi	..	..	..	101	16
District average	..	..	..	56	10
Chou moellier :					
1st, C. Watson, Huirangi	..	..	..	71	13
2nd, E. Corlett, Ratapiko	..	..	..	56	5
3rd, E. Zimmerman, Kaimero	..	..	..	45	9
District average	..	..	..	30	13
Best-kept plot : Stanley Cloke, Lepperton.					

South Taranaki :—

Mangels (Barres Stryno) :					
1st, Geo. Loving, Huinga	..	..	..	181	5
2nd, Gladys Taylor, Fraser Road	..	..	..	138	17
3rd, Jack Nichol, Toko	..	..	..	110	17
District average	..	..	..	72	0
Carrots (Matchless White) :					
1st, H. Goblin, Ararata	..	..	..	59	12
2nd, G. Lundberg, Ararata	..	..	..	59	6
3rd, R. Anderson, Toko	..	..	..	59	9
District average	..	..	..	42	1
Best-kept plot : R. Anderson, Toko.					

Wanganui :—

Mangels :					
1st, Lily Powell, Kohi	..	..	..	149	15
2nd, C. McCandlish, Ngaturi	..	..	..	139	13
3rd, Alison McCandlish, Ngaturi	..	..	..	132	15
District average	..	..	..	64	0
Carrots :					
1st, Alson McCandlish, Ngaturi	..	..	..	77	2
2nd, Nora Munro, Ngaturi	..	..	..	77	2
3rd, Lily Powell, Kohi	..	..	..	72	0
District average	..	..	..	40	0

Feilding :—

Mangels :					
1st, D. Meehan, Longburn	..	..	..	121	6
2nd, S. Spring, Moutoa	..	..	..	114	2
3rd, R. Hill, Rongotea	..	..	..	111	13
District average	..	..	..	56	2
Maize :				Bushels.	
1st, Doug. Jansen, Kiwitea	..	..	..	66.4	
2nd, H. Jakobsen, Taonui	..	..	..	65.2	
3rd, Mona Christensen, Oroua Downs	..	..	..	82.1	
District average	..	..	..	42	

Wairarapa :—

Mangels (Prizewinner) :				Tons cwt.	
1st, Rod Percy, Te Oro Oro	..	..	..	105	18
2nd, Alex. Hart, Te Whiti	..	..	..	90	13
3rd, Ron McGovern, Mauriceville	..	..	..	87	2
District average	..	..	..	41	1

Taihape :—

Mangels (Red Intermediate) :					
1st, Phil. Klat, Mangaonoho	..	..	..	135	12
2nd, Avis Prime, Ohutu	..	..	..	83	12
3rd, Hugh Dallas, Otamakapua	..	..	..	75	10
District average	..	..	..	55	0
Carrots (Matchless White) :					
1st, Lloyd Rowe, Mangaonoho	..	..	..	68	2
2nd, Lily Bielski, Karewarewa	..	..	..	61	17
3rd, Winifred Dellow, Utiku	..	..	..	34	12
District average	..	..	..	47	0

It will be noticed that in some cases the weight figures do not coincide with the placings, but in these cases the differences were brought about by a difference with some other marks, probably for chart.

Exhibitions of roots grown by competitors were again staged at the Wanganui, Hawera, New Plymouth, and Wellington winter shows. The Henry Lane and Co. Dominion challenge shield for the greatest number of points in club work was won by Ararata School, in South Taranaki.

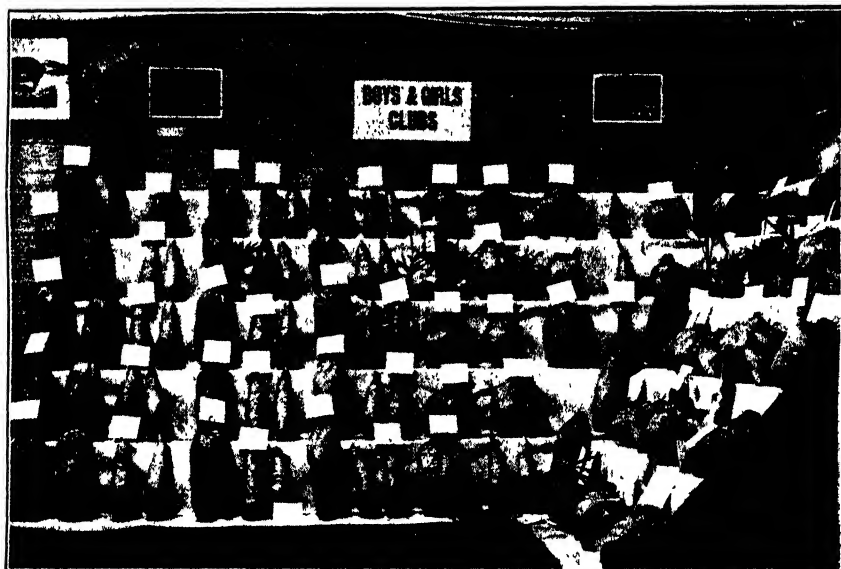


FIG. 3. EXHIBIT OF ROOTS FROM PRIZE-WINNING CROPS AT WELLINGTON WINTER SHOW, 1929.

The Stuart Wilson Cup is seen in centre.

Senior Clubs.

This was the third season of work with the senior clubs. The difficulty with this intermediate competition is to get in touch with the competitors again after their secondary education is completed. Many of the junior competitors on leaving the primary school go to live in the nearest town where a secondary school is situated, thus in a way breaking touch with the country. However, plans are in train whereby organizers of this branch of the competitions will be able to get in direct touch with those going back to the farms, and it is hoped that entries will then increase. In North Taranaki the senior competition was with mangels (Prizewinner) and in South Taranaki with mangels and carrots. In North Taranaki a further manurial trial was conducted, the manures under trial and the results being as follows :—

	Tons cwt.
Basic manure (super 3 parts, bone 1 part, Nauru phosphate 1 part)	68 13
Basic manure plus muriate of potash	69 12
Basic manure plus 30 per cent. potash	57 13
Basic manure plus kainit	50 14

The competition winners were as follows:—

North Taranaki :—

Mangels :				Tons cwt.	
1st, D. Muir, Brixton	..	..	..	82	12
2nd, L. Corlett, Ratapiko	..	..	..	76	2
3rd, J. Corlett, Ratapiko	..	..	..	58	11

South Taranaki :—

Mangels :					
1st, Ron Taylor, Fraser Road	..	..	..	95	5
2nd, Geo. Feather, Kokiri Road	..	..	..	70	3
3rd, Lloyd Walker, Otakeho	..	..	..	66	4
Carrots :					
1st, Harry Feather, Kokiri Road	..	..	..	47	5
2nd, D. Campbell, Otakeho	..	..	..	41	15

As in past years, the co-operation between teachers, parents, supervisors, instructors, and competitors has gone a long way towards the success of the movement, and thanks are due to all helpers and donors of prizes.

AWARD OF STUART WILSON CUP FOR 1928-29 SEASON.

THE cup presented by Mr. W. Stuart Wilson, of Wellington, for annual competition among boys and girls' agricultural clubs was won this year by Dudley Tayles, of East Gore School, Southland, with an outstanding crop of potatoes yielding at the rate of $31\frac{1}{4}$ tons per acre. The runner-up was George Loving, Huinga School, South Taranaki, who grew a crop of mangels which weighed out at the remarkable rate of 181 tons 5 cwt. per acre. For the purposes of comparing these two crops it was considered necessary to take into consideration their value, and on the basis of the current values at the time of judging the potato crop was worth £156 and the mangels £135 15s. per acre.

In accordance with previous practice the Department of Agriculture has presented Dudley Tayles with a gold medal and a photograph of the cup as a permanent record of his win.

GOVERNMENT ASSISTANCE TO THE CLUB MOVEMENT.

THE Department of Agriculture and the Education Department have lately been giving close consideration to the question of reorganizing the control of boys' and girls' agricultural clubs and of granting further assistance to them. The Minister of Agriculture (Hon. G. W. Forbes) recently approved of a scheme of control and assistance of which the following are the main points: (1) Where any approved district organization is set up to develop the club movement the Department of Agriculture will subsidize any funds that such organizations may collect, up to a maximum of £40; not more than two such organizations to be subsidized in any one Education Board district; the Department to have the right to appoint the chairman of any of the organizations that are subsidized. (2) The Department to provide the seeds and manures necessary for the clubs that are formed. (3) The Department to supply all charts and certificates in connection with the work. (4) All possible assistance to be rendered to the organizations set up.

STERILIZATION OF DAIRY APPARATUS.

LIVE STEAM EFFICIENCY TEST AT WALLACEVILLE.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Bacteriologist, Wallaceville Laboratory

A TEST was recently carried out at the Wallaceville Laboratory regarding the efficiency of steam sterilization of dairy apparatus by a "Cleena-Milk" outfit (Barford and Perkins) recently imported from England. For the purpose of the test, arrangements were made for the use for one week of all detachable parts of the milking-machine of a dairy-farmer located near the Laboratory. During this time all parts of his plant, except two lengths of milk-pipe which were not readily detachable, were sterilized for half an hour at boiling-point. It was found necessary to omit the cooler after the second day, as disconnecting it gave a good deal of trouble (Figs. 1 and 2, page 340).

All parts of the plant stood sterilization extremely well; teat-cup rubbers and all sound rubber parts of the plant remained unchanged. Rubber connections between the teat-cups and milk and air pipes, already nearly perished, became sticky and plastic after the first sterilization: these were rejected and new rubbers of the same type put on. These remained unchanged after sterilization.

The original bacterial count of this farmer's milk was taken into consideration, as he appeared to be running his plant in a cleanly manner. Four samples of milk were taken from the plant before sterilization was commenced, and gave the following counts of organisms per cubic centimeter: No. 1, 2,256,000; No. 2, 2,912,000; No. 3, 4,480,000; No. 4, uncountable. *Bacillus coli* was present in each sample.

The plant was taken down after the morning's milking, cleaned, and then sterilized for half an hour at boiling-point. After each sterilization the various parts of the plant were washed with known quantities of sterilized water, care being taken to prevent recontamination from the atmosphere. The following quantities of sterilized water were used for washing: Cooler, 1,000 c.c.; cooler-tank, 1,000 c.c.; downpipes (three), 500 c.c. each; teat-cups, 1,000 c.c. between three sets; releaser, 1,000 c.c.; can, 1,000 c.c.

Samples were then taken from this water after it had been carefully passed over all surfaces of the part treated, and cultured on standard agar by the shake-culture method. The findings in three-day cultures for all six series are given in the following table:—

Results from Cultures of Washing-water Samples.

Apparatus.	Growth.	Presumptive Bacterial Count.
<i>First Day.</i>		
Cooler	One colony..	1,000 organisms.
Cooler-tank	Two colonies ..	2,000 organisms.
Pipe 1	Six colonies ..	3,000 organisms.
Pipe 2	No growth ..	..
Pipe 3	No growth ..	..
Teat-cups	No growth ..	..
Releaser	One colony ..	1,000 organisms.
Can	One colony..	1,000 organisms.

Results from Cultures of Washing-water Samples—continued.

Apparatus.	Growth.	Presumptive Bacterial Count.
<i>Second Day.</i>		
Cooler	No growth ..	..
Cooler-tank	One colony ..	1,000 organisms.
Pipe 1	No growth ..	..
Pipe 2	No growth ..	..
Pipe 3	No growth ..	..
Teat-cups	No growth ..	..
Releaser	One colony ..	1,000 organisms.
<i>Third Day</i>		
Cooler	No growth ..	..
Cooler-tank	No growth ..	..
Pipe 1	No growth ..	..
Pipe 2	No growth ..	..
Pipe 3	No growth ..	..
Teat-cups	No growth ..	..
Releaser	No growth ..	..
<i>Fourth Day.</i>		
Cooler (omitted) .. ..	..	..
Cooler-tank	No growth ..	..
Pipe 1	No growth ..	..
Pipe 2	One colony ..	500 organisms.
Pipe 3	No growth ..	..
Teat-cups	No growth ..	..
Releaser	One colony ..	1,000 organisms.
<i>Fifth Day</i>		
Cooler (omitted) .. ..	..	..
Cooler-tank	No growth ..	..
Pipe 1	No growth ..	..
Pipe 2	One colony ..	500 organisms.
Pipe 3	No growth ..	..
Teat-cups	No growth ..	..
Releaser	No growth ..	..
<i>Sixth Day.</i>		
Cooler (omitted) .. ..	..	..
Cooler-tank	No growth ..	..
Pipe 1	No growth ..	..
Pipe 2	No growth ..	..
Pipe 3	No growth ..	..
Teat-cups	No growth ..	..
Releaser	No growth ..	..

NOTE.—*Bacillus coli* was absent in all the above counts.

These results give highly satisfactory evidence of the efficiency of steam sterilization for half an hour at boiling-point.

The quantity of coal used in the boiler at Wallaceville for generating steam and holding the "Cleena-milk" chest at boiling-point for half an hour amounted to only 25 lb. daily, costing 9³/₄d., or £14 16s. per annum. The boiler at Wallaceville is much larger than is necessary for heating the steam-chest only, as it is required for the pasteurizer in the experimental dairy. Boilers supplied by the manufacturers of these outfits are much smaller and lighter in design, and would burn less coal, reducing the annual cost of running still further.

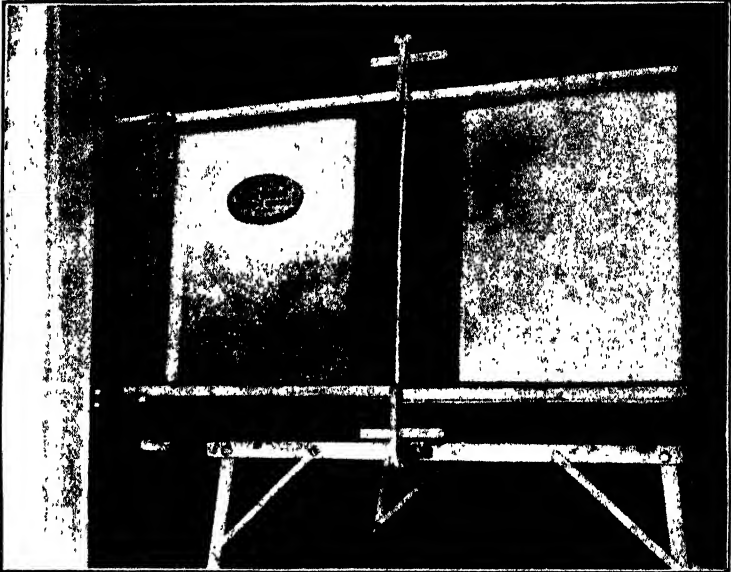


FIG. 1. THE "CLEENA-MILK" STERILIZING-CHEST AT WALLACEVILLE LABORATORY

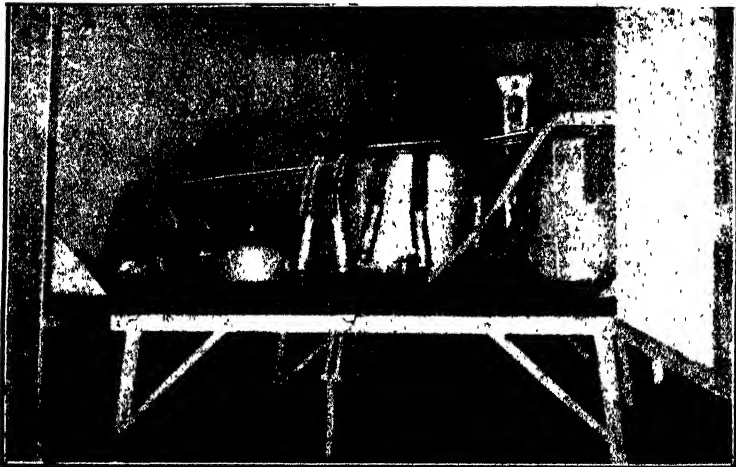


FIG. 2. CHEST OPEN, SHOWING APPARATUS PLACED FOR STERILIZING.

The types of organisms found present on the agar plates that would appear to have escaped sterilization were subcultured and examined under the microscope. Of these organisms three were spore-forming aerobes, two of which were *B. subtilis*, one rough and one smooth type; one a colony of *Sarcinae*; several cocci-forming, very viscous colonies, with marked acidity production on lactose agar; and two colonies of gelatine-liquefying cocci. Further experiments for determining the exact thermal death-point of these organisms are now being carried out.

SEASONAL NOTES.

THE FARM.

THE PASTURES

WEATHER conditions having made the current season a late one, the difficulties of properly controlling pasture growth have not presented themselves this year as soon as is usual, but it is probable that before midsummer arrives many farmers will have on hand surplus pasture growth which they can deal with most advantageously only by resorting to ensilage-production.

The farmer has no occasion to make ensilage-production a rival or an alternative to hay-production: that is to say, it is not a question whether he should make ensilage rather than hay, or whether he should make ensilage only if there is a surplus growth after adequate areas have been reserved for the hay supply considered necessary if ensilage is not taken into account at all. Often there is excellent scope for the production of both hay and ensilage, and if both are produced a feature of good management is introduced in that the labour of handling the pasture surplus is spread over a longer period, and is thereby likely to be made less disturbing to routine farm-work. In favour of making some ensilage instead of hay only are the following considerations:—

(1) The ensilage-production, being independent of weather conditions, can be attended to at the time proper to the welfare of the pasture growth, whereas if one waits for good haymaking weather it is often impossible to carry out the earlier mowing which suits the pasture, and which allows of the development, before the dry midsummer weather arrives, of the second growth, or aftermath, that is so valuable as a source of fresh young forage which it is somewhat difficult to secure otherwise at that season.

(2) A supply of ensilage is advantageous in that it can be used with good results, should a period of shortage occur, as a summer forage for dairy cows, whereas had the nutriment been stored away as hay it could not be so used.

Topping the pastures by running the mower over them when they show signs of producing seed-stalks is at times carried out too late to obtain from the practice the greatest possible benefits. A paddock topped early in December should be supplying at New Year considerable fresh leafy forage, which it would not produce were the topping not carried out at the right time. The necessity for topping of pastures is specially likely to arise principally on two types of farms—those on which there is not an adequate number of dry stock to follow the stock in milk and clean up growth which it does not prove advantageous to force the wet stock to consume; and, secondly, those farms on which harrowing of pastures does not receive adequate attention, and on which it is most difficult to keep closely grazed the growth which comes in patches in the vicinity of the undisturbed droppings.

Harrowing of pastures to break up and scatter the droppings is often highly desirable during December. In doing this work results obtained by harrowing first in one direction over a paddock, and then, at right angles to the first harrowing, across the paddock, are far better than the results obtained by putting in the same amount of labour harrowing round and round a paddock in the one direction. Harrowing of pastures during December or thereabouts specially calls for attention, because when a dry spell comes, even though a considerable number of

droppings has accumulated, it may not be possible to harrow with advantage on account of the soiling of the pasture which may result, and which can be removed satisfactorily only by rain.

FORAGE-CROP CONSIDERATIONS.

At this season of the year probably the most neglected aspect of forage-crop production is that of cultivation. This applies both to crops which are yet to be sown and to those the seedlings of which are already above the ground. Cultivation seems to be looked upon by some merely as a means of keeping weeds in check, and hence as a matter calling for action only when the weeds are becoming a nuisance. As a matter of fact, weed-control is only one of the several important objects of cultivating land, both before and after the crops have become established. The value of the cultivation which produces a good seed-bed is generally recognized, even though some at times, judged by their practice, seem to overlook the necessity for a good seed-bed. But the value of the cultivation after the sowing of the seed is not so generally understood, and hence this cultivation work is more neglected than is the cultivation needed to produce a suitable seed-bed. The position, summed up, is that, apart altogether from weeds, a growing crop in ground badly cultivated cannot obtain the full benefits from quality in seeds, and from the free use of high-class manures; and, further, if a spell of dry weather occurs, such a crop is apt to suffer from an inadequate supply of soil-moisture which suitable surface cultivation would help one to avoid. Hence intertillage of growing crops sown in rows wide enough to allow of it is highly desirable, even though weeds are not disagreeably prominent.

Often in December, hand-in-hand with tillage between the rows, goes the work of thinning and weeding of crops sown in October or November—work which is made easier and more effective by prior hoeing along the rows.

Thinning, though seldom completely neglected, is often so delayed that the plants which remain after thinning have been seriously and permanently weakened by their struggle with the plants which have been removed. Undue delay in thinning not only injures the crop, but also makes the work of thinning more difficult. The best time to do thinning is as soon as the seedlings are of sufficient size to allow of the plants being handled without too much difficulty. The weeding which accompanies such early thinning enables weed seedlings freely to be destroyed at their most tender delicate stage.

During December work which will require attention on many farms will be the sowing of such crops as swedes, soft turnips, and rape. In connection with such sowing, seed injury is apt to occur if the seed is placed in the soil adjacent to any considerable amount of superphosphate, and the amount of injury is likely to become of moment when a dressing of superphosphate in excess of 1 cwt. an acre is so used. Injury may be avoided by using a slower-acting manure such as basic super, or a mixture of carbonate of lime and superphosphate in equal proportions. Further, the fairly common practice of mixing seeds of the above-mentioned crops with manure prior to sowing is likely to result in a field germination failure if the manure happens to be superphosphate and the seed has been lying mixed with it even for a relatively short period, such as two or three hours. Such mixing, however, can be safely carried out with phosphatic manures which are not soluble in water, such as Ephos, basic super, &c.

HAYMAKING.

Grass growth to be made into hay is very often cut at a stage too mature to allow of the production of hay of the best possible quality. The growth is allowed to become overmature because of two main facts. The first of

these is that when the growth is at the stage best suited for mowing, so as to produce hay of the highest possible quality, the weather is not at all suitable for haymaking; the farmer makes what he considers the best choice under the circumstances by waiting until he can expect good weather and so losing not only quality in his hay, but his chance of getting the plentiful aftermath on the hay-paddock which the earlier mowing would tend to secure. The other fact which operates against earlier mowing for hay is that many do not fully realize the advantages to be gained by mowing, when weather allows, much earlier than is often done, they do not realize that the changes which occur in plants after they have reached their early flowering stages reduce rather than increase the value of the crop from the hay standpoint, in that the digestibility of the forage is seriously impaired without effecting any material increase in the weight of nutriment.

Should a period of bad weather be experienced immediately after an area is mown it is good practice to leave it, within reason, undisturbed completely until it is felt that the weather has again picked up, for any handling that the mown material receives makes it more subject to washing-out of the valuable nutriment that it contains, should rain follow. Again, when bad weather may be expected it is often good practice to hurry to get the green material into the coked stage, for when in cocks the material does not suffer so much washing-out of nutriment as would the same material if scattered over the whole field.

Especially when an early saving of the hay crop has been effected, good results are obtainable by top-dressing the field immediately after the removal of the hay, in order to stimulate the quick development of the subsequent grass growth. For this top-dressing superphosphate generally proves excellent.

MISCELLANEOUS.

During December on many farms butterfat-production will be found to be falling at an unduly fast rate. This occurs although there is still plenty of grass growth available, and is due to the fact that much of such growth is too mature to serve as high-class feed for animals of heavy production. The position will be relieved if the pasture-topping already mentioned has been carried out, or if suitable young forage such as a second growth on a lucerne-field is available to supplement the pastures. The essential feature, often overlooked, of such forage is that it be relatively free from fibre or woodiness, and therefore young and leafy. Maturer forage-crop material is not superior to the pasture growth itself, and, if available, should be made into hay or ensilage.

Attention should be given in good time to ensuring that all harvesting requisites will be available when required. This applies particularly to the reaper-and-binder and to the mower. In regard to these, the replacement of worn-out parts is often just as advisable as the replacement of broken parts, and the replacement in either case usually calls for considerable time which can ill be afforded when harvesting is actually in progress.

—R. P. Connell, M.A., *Fields Division, Palmerston North.*

PREVENTIVE MEASURES AGAINST LYMPH-ADENITIS IN SHEEP.

In the *Journal* for January last an outline was given of the disease known as caseous lymph-adenitis in sheep, with particular reference to its nature and the preventive methods to be used in order to limit its occurrence as far as possible. Now that the authorities in Britain are paying special attention to the discovery of this disease in imported mutton and lamb carcasses, including the thawing-out of a certain percentage of these, it is imperative that every endeavour be made to

prevent as far as possible any affected carcasses reaching the overseas market. The Department of Agriculture is accordingly strengthening its meat-inspection staff to this end, and extreme vigilance will be observed at freezing-works. But in addition to this, and in order that the very moderate incidence of the disease in New Zealand may be reduced, with a view to its eventual elimination, the co-operation of all sheep-farmers is essential.

At the Department's Veterinary Laboratory experimental work in this disease showed that the chief means by which the disease is transmitted is the entrance of the causal organism through wounds or abrasions of the skin. It is therefore obvious that wounds incurred during the operations of castration, docking, shearing, crutching, &c., are all sources by which the germ may gain entrance and set up the disease.

All blades used in shearing should be sterilized by boiling before the work commences, and dipped in an antiseptic fluid at frequent intervals during the operations. For this purpose machine-oil to which carbolic acid has been added in the proportion of one to ten is effective. All wounds inflicted should be immediately dressed with Stockholm tar, which, while not one of the strongest antiseptics, has the advantage of sticking to and forming a cover over the wound.

The floor of the shed should also receive attention. This may probably have been used for seasons without being thoroughly cleaned. Before operations commence the floor should be thoroughly scrubbed with an antiseptic fluid. All posts and division rails inside the shed should be similarly treated.

Through years of frequent use the yards are liable to become infected with the germ of the disease. It is essential, therefore, that this area should also receive careful attention. The surface soil should be well turned over, after which it should be liberally sprinkled with an antiseptic solution, following which a dressing of quicklime should be applied. All gates, posts, rails, &c., should receive a coating of tar, or lime-wash containing carbolic acid. The holding-paddocks adjacent to shearing-sheds are also frequently much soiled, and should be periodically, as opportunity occurs, ploughed up and allowed to lie to the sun before resowing.

When docking and castrating lambs care should be taken to see that the operation is not carried out for any two seasons in succession on the same area. The shearing-yards should be avoided as a site for this operation. Knives, instruments, and the hands of the operator should be sterilized before operating, and all antiseptic precaution taken during operations.

Although, naturally, the infection of lymph-adenitis may be present on any part of a farm, we feel sure that the shearing-shed and its vicinity, through frequent crowding of sheep, is the place where the risk is greatest, and that if the precautions here outlined were put in practice the incidence of the disease would be very considerably reduced.

—*Live-stock Division.*

THE ORCHARD.

CULTIVATION.

CULTIVATION will be continued during the coming month as opportunity offers, both for the suppression of seedling weeds and moisture-conservation. So many phases of fruitgrowing demand attention during the first two or three months of the growing-season that it is often very difficult to keep up with the routine, but any slackening in cultivation in the early part of the season usually results in a heavy growth and seeding of weeds

later on, when the weight of fruit precludes the use of implements. Deficiency of moisture is not likely to be apparent until well on in the ripening-season, when the rainfall is not sufficient to replace natural losses, consequently with late-ripening varieties such as Sturmer and Dougherty development is checked, colouring retarded, and the crop will pack out a large proportion of undersized, premature, reject fruit. The necessity for disking or harrowing land that is clean and in good condition may not be apparent, but not knowing how dry the season will be it is an operation that few can afford to neglect if the maximum is to be obtained for the year's working. Frequently stirring the surface is the only sure way of reducing loss through evaporation and retaining moisture in the levels occupied by the roots.

THINNING.

Thinning should be commenced as soon after the natural drop has finished as a good idea of the size of the crop can be obtained. Much of the benefit of thinning is lost if development proceeds to any extent before the surplus fruit is removed; but as varieties (more especially apricots) vary so much in different localities, previous behaviour must be relied upon to indicate when it is safe to thin without the danger of experiencing a late drop. Small fruit is an abomination inasmuch as the market for this class is limited, the cost in handling is greater than with large sizes, and too much of the crop goes into the reject bin. By limiting the crop a better average size is produced, the weight is more evenly distributed over the tree, disease-control is less difficult, handling-costs are reduced by eliminating the undersized fruit, and by enabling the tree to produce more wood the tendency to alternate-year cropping is lessened.

More growers err towards underthinning than overthinning, and the happy mean can only be obtained by considering the factors governing size. The habit of the variety, size and distribution of the crop, physical condition of the tree, and possible effect of adverse weather conditions must be studied and acted upon. Medium- to small-sized varieties will naturally receive heavier thinning than the larger kinds, but by reducing the crop too drastically with varieties like Jonathan and Cleopatra soft-fleshed fruit of poor keeping-quality may be expected. Apple and pears fruiting in clusters are usually left with from three to one to a spur, or sometimes alternate spurs are stripped. Short-stemmed varieties need careful spacing to prevent loss at picking-time, otherwise when one fruit is picked the remainder of the cluster will fall and become a loss.

Commence by removing any misshapen, blemished, or diseased fruits, and reduce to the required number of as near uniform size as possible. The centre apple in a cluster is usually short-stemmed and liable to be pushed off by the remaining fruit, and should be removed. In Delicious the centre fruit, or any others that develop at a much greater rate than the remainder, should be regarded with suspicion and discarded, for to these much of the mouldy-core trouble is traceable. Care should be taken to ensure that a portion of the stem remains on the spur. If the stems are torn off with the fruit the cluster is weakened and often falls.

Peaches, nectarines, and apricots should be spaced so that, when developed, no fruit touches its neighbour. Weak, willowy growths should be thinned to an ultimate height in conformity with their strength.

SPRAYING.

Spraying now will have become a routine operation, and the increased leafage will require a greater amount of material and more careful application if the full benefit is to be derived. No portion must be missed, and the frequency with which clusters of moth-infected fruit are seen on the ends

of long branches is sufficient to convict the man behind the spray-gun of having taken a long shot and missed—leaving a small portion without a protective covering, to become infected and stand out in contrast to the remainder of the tree.

Red mite and leaf-hopper may now be expected in increasing numbers, and the weakening of the lime-sulphur will decrease control. The devitalizing effect of red mite will seriously depreciate the value of the crop, the foliage assuming a blackened appearance and failing to function efficiently. Oil sprays, 1-100, plus Black Leaf, 1-800, plus spreader or special summer oils according to manufacturer's directions, will give satisfactory control. If necessary repeat in about a fortnight. Powdery mildew will require precipitated sulphur, 10-100, or dry-mix, and should not be neglected. In mixing combination sprays the correct sequence of adding the ingredients should be adhered to, or the efficiency of the spray will be lessened or destroyed. Spray burning is often attributable to failing to keep the ingredients in suspension by agitation, or to adding fresh material to spray that has been left standing.

Codlin-moth and leaf-roller control will be continued, and pears will require another black-spot spray of either bordeaux or lime-sulphur, according to variety. Stone-fruits will receive sulphur sprays according to weather conditions, but at intervals of not more than three weeks. On first appearance of pear slug, spray with arsenate of lead.

TYING AND PROPPING

Props should be assembled in readiness for use, but in order to maintain cultivation as long as possible they should not be used until it is necessary. Now is a good time to overhaul any wiring or tying systems. It may be necessary to either raise existing wires or add others at a higher level, in order to prevent the weight above the stay from breaking the limbs. The use of screw-eyes inserted on the inside of the limbs at the required heights will be found quite satisfactory, and makes a use for wires broken in packing.

GRAFTS.

Grafts should be examined occasionally, and any ties above which the bark is beginning to bulge should be cut out by running a knife down the side of the limb opposite to the graft, leaving the tie adhering loosely. Sucker shoots breaking on the stump should not be removed too drastically, but allowed to develop to assist in maintaining the balance between root and top, in positions where they are not likely to take the lead from the graft. If the grafts are lagging they may be stimulated by pinching out the tips of adventitious shoots. In exposed situations it will be advisable to protect the grafts by staking, either securing the stake to the limb or driving three stakes into the ground equidistant round the trunk and bracing with strong twine. Grafts should not be omitted from the powdery-mildew sprays.

PICKING.

Stone-fruit picking will soon commence, and the grower's desire to get the first of the market often causes loss to the retailer and disappointment to the purchaser when immature fruit is marketed. Development should have proceeded only to the hard-ripe stage in peaches, nectarines, plums, and apricots, in order to give the retailer a reasonable prospect of disposal before they become overripe. The lightening of the ground-coloured portion provides the best indication of the right time to pick, and the proximity to market and length of time before the fruit is to be offered for sale must be taken into consideration.

Citrus-culture.

Growth on citrus-trees should now be well started, and if undesirable shoots can be rubbed out before they harden much time will be saved later on. Bordeaux, 4-4-40, should be continued for the control of verrucosis and fungoid diseases, if required, as young growth increases. Oil-spraying at 1-60 may be carried out when the main blossoming has finished and the young growth has started. Oiling before growth commences will produce serious defoliation. Red scale is the principal pest to receive attention, and any neglect will be reflected in the defoliated condition of the tree, as well as rendering the scale-infected fruit unfit for sale. Red scale to a lemon-tree is what San Jose scale is to a deciduous tree; though the individuals are small they multiply very rapidly, and their numbers are a severe strain on the tree's resources. This small, round, reddish-yellow scale may be found on every portion of the tree above ground, including the fruit, and its distribution necessitates very careful and thorough spraying. It is generally advisable to make a second application about a fortnight later, so as to catch adults or later hatchings which may have missed the first spray. For the control of thrips which blemish the surface of oranges, causing roughened pale-coloured patches, the addition of Black Leaf 40 will be beneficial. *Icerya purchasi*, the cottony cushion or fluted scale, will now be hatching, and, although held in check fairly well by the ladybird *Vedalia cardinalis*, any colonies should be immediately dealt with.

—G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

THE GROWING PULLETS.

THE time is now opportune to reiterate the advice that too much care cannot be taken in the feeding and handling of the growing pullet. The whole object of feeding during the period from incubation to the commencement of the laying-period should be to develop the bird's body and to build up her constitution. Many people force their pullets with rich food in order that they may commence to lay at an extremely early age. This is very undesirable; under such conditions the birds cannot grow into vigorous stock, while from a productive standpoint they will probably prove unprofitable, as in most cases their eggs will not be of sufficient size to warrant top prices, furthermore, they will never make desirable breeding-stock. It stands to reason that when fowls have been bred for generation after generation with the object of extreme egg-production the natural inclination to lay is so strongly developed that no forcing methods are needed to make them lay as soon as they have reached the correct productive age.

There is ample evidence that early maturity is not necessarily an indication of egg-laying capacity, and that premature laying is not a sign of the desirable breeding-bird. The principle that constitutional vigour is the basis in the breeding of all classes of live-stock cannot be too strongly emphasized, but with the high-type layer, upon which there is such an exceptional strain, constitution is of special significance, and constitution will never be maintained in a flock from which are bred birds which have been brought to profit before being fully developed. It will be realized that I am not speaking of the early laying of the well-developed bird, but of the pullet which commences to lay when only little more than half-grown.

The mistake should not be made of allowing the cockerels to run too long with the pullets. Obviously, if the former are to be well fed in order to put them into a good marketable condition at the age, say,

of four and a half months, the pullets will be unduly forced. The future table cockerel should be rapidly developed, and to this end should have a restricted range and a rich diet, whereas the pullet should have good range and an ample but simple ration. In other words, the future table cockerel demands artificial conditions, and the pullet as natural a scheme of treatment as possible. This does not imply any stinting of food, but rather that everything should tend to strong development, for on the treatment of a pullet during the period of her development very largely depends her future success as a layer. About six months old is a good time for a bird of a laying strain to commence her laying season, and this may be extended a month in the case of the heavy breeds.

OVERSUPPLY OF MEAT-SUBSTITUTES.

The desire to secure a big egg-yield has led several correspondents to overforce their birds with meat-substitutes, and ovarian troubles such as protrusion of the oviduct are a natural consequence. It is true that a liberal supply of nitrogenous material is essential to heavy egg-production, especially during the colder months of the year, but there is a danger that this may be carried out to excess during the spring and summer months. Obviously a bird does not require the same forcing-food at the present natural season as she does in winter, when egg-laying may be regarded as more or less artificial. The proportion of such materials as blood-meal and meat-meal should be reduced now, especially where birds have a free range, and thus have an opportunity, especially after rain, of picking up insects, worms, &c.

Not only does an overforcing ration tend towards ovarian disorders, but it also induces the production of thin-shelled eggs and eggs containing blood-spots. The chief danger in feeding a heavy meat ration is where this material is mixed with the mash and the latter is fed to all members of the flock quite irrespective of their age and laying-power. The oversupply of meat food is specially accentuated where the supply of grain material is not as liberal as it should be, which often happens owing to the poultry-keeper's incorrect reasoning that an extra supply of concentrated meat food will make up for the inadequate supply of grain.

It will usually be found a wise course, especially where a large flock is concerned, to feed highly nitrogenous material such as blood or meat meal sparingly in the morning mash, but it should also be always available for the birds to pick at in a separate receptacle. In this way ovarian disorders will be reduced to a minimum, as the bird is given an opportunity of balancing its own ration according to nature's dictates, and she can usually be relied upon to do this better than we can do it for her.

Speaking of meat-substitutes, a case came under my notice recently in which heavy mortality was taking place in a flock. On investigating the trouble it was ascertained that the owner of the plant had purchased and included in the mash a meat-and-bone mixture that had been specially prepared as a fertilizer. It was easy, under the circumstances, to point to the cause of the trouble. This is by no means the first case of the kind which has come under my notice, and it should be a warning to poultry-keepers that only those meat mixtures which are specially prepared for feeding to fowls should be used for that purpose.

Referring again to ovarian disorders such as protrusion of the oviduct, it may be mentioned that a trouble which is often confused with these is caused by a hen picking at the oviduct of another bird just when the latter is in the act of expelling an egg. This brings on a severe hæmorrhage, with the result that the other birds in the flock will pick at the bleeding

part, and often pull out the bowels and oviduct of the victim, causing it a cruel death. Where birds have acquired this vice, the only safe course is to darken the nests, or arrange them in such a way that the oviduct of the bird cannot be seen or picked at when in the act of laying. When a bird is on the point of expelling an egg, the oviduct protrudes more or less, and presents a highly flesh-coloured appearance. This induces the culprit, in its desire for animal food, to pick at and puncture the delicate organ. Careful observation will often locate the culprit, which frequently will be seen walking along in front of the nest-boxes, waiting for an opportunity to satisfy its cannibalistic inclination. Obviously, if such a bird is detected it should be immediately got rid of.

THE BREEDING COCKEREL.

The cockerel that has been selected for future breeding purposes should be treated in a similar manner to the growing pullet, and be given every opportunity to make slow but sound development. This implies plenty of plain nourishing food and ample range for exercise. As in the case of the pullet, premature maturity should be carefully guarded against. It is seldom or never that a very early-maturing male will grow to a desired size for the production of highly desirable stock. The same may be said in regard to the coddled bird, which cannot be regarded as being developed on sound principles, and the earliest and most common proof of this is often manifested in a weakness of the legs. Coddling, overcrowding, badly ventilated quarters, insufficient exercise, and high feeding are the principal causes of leg-weakness and kindred troubles which affect birds during their developing-period. Leg-weakness is one of the several indications that the vital essential in breeding poultry—maintenance of constitution—is not considered as it should be. It is easy to understand that the feeding of rich food to birds confined in small runs encourages size of body rather than sound development of the frame required to carry it.

For the production of good-sized bodies, and bone of the right quality and thickness, there is no food equal to good plump oats. Given whole it is difficult at times to get the birds to eat them. Trouble in this respect may be minimized by purchasing oats that are clipped or, better still, shelled. Do not neglect to give the birds an adequate supply of freshly crushed oyster-shell. This is of equal importance to the growing birds as to the laying hen, in providing lime for bodily requirements, and particularly bone-making.

Green food is absolutely necessary in the chicken stage. It is only during a short season, and then not at the present period, when it is required, that grass in the runs makes satisfactory green food. It is only the young tender shoots of the grass that are of value. Other green material must be supplied, such as chaffed lucerne, clover, silver-beet, cabbage, lettuce, and, best of all, watercress—that is, when tender leaves of the plant are available.

—F. C. Brown, *Chief Poultry Instructor, Wellington.*

THE APIARY.

FORMING NUCLEI.

WITH the approach of the main honey-flow and the prospect of [more settled weather the beekeeper can turn his attention to the matter of forming nuclei, either with an eye to artificial increase or for queen-raising purposes. Whatever the object for which they are produced, the simplest method of forming nuclei is as follows:—

From the strongest colonies in the apiary take combs of sealed brood with adhering bees. Place two of these combs in each nucleus

hive, together with one comb of honey and an empty comb. It is as well, if the size of the hive will permit, to add a feeder. Close the entrance of the nucleus hive by tacking over it a piece of perforated zinc or wire cloth, and place the newly formed colony in a cool place for twenty-four hours. At the end of this time the hive may be placed on its permanent stand and the entrance opened. Some of the field-bees will return to the parent hives, but in the meantime much of the sealed brood will have hatched, and thus the absconders will hardly be missed. The small colony can at any time be given a ripe queen-cell, and under favourable weather conditions will soon possess a laying queen.

Nuclei can be built from one or two strong colonies, each of which should produce four or five small colonies; or several hives in the apiary may each be robbed of a frame of brood, thus providing increase while leaving the full colonies practically undiminished. When the young queen commences laying in a nucleus hive she should be left in possession until she has filled two frames with eggs, when she may be removed and given to a colony which requires requeening. The nucleus should at the same time be supplied with a ripe queen-cell, and the process repeated as long as young queens are required.

REQUEENING.

The most important bee within the hive is the queen, and it is useless to expect a colony to be productive unless she is a good one. It is therefore quite essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding queens, and others retained on account of desirable drones. Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year. If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured, and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. In New Zealand it has been proved that the best months for raising queens are from November to January. During this period everything is favourable for the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are also at their best, this being the swarming-period. There is practically no risk of robbing; the young queens are readily accepted, and will tend to reduce swarming. Moreover, a queen introduced during the months of prosperity will produce numbers of young bees for the winter, and still be fairly young in the following spring. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy method of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance is then contracted, and a few vigorous puffs of smoke are forced in at it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance,

piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke. The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly, and left like this till the next day, when the full entrance can once more be allowed.

DISEASE.

If the weather conditions have not been favourable for the treatment of foul-brood this should be undertaken when the first opportunity occurs. Do not delay until the main flow arrives. Remember that if colonies are treated early enough a surplus of honey will be secured and the expense of treatment recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Particulars of the treatment of foul-brood have been given in these notes, and if fuller information is required this will be found in Bulletin No. 119, "American Foul-brood and its Treatment," which can be obtained free from the Apiary Instructor in each centre.

--E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE TOMATO CROPS.

In unheated glasshouses the more valuable bunches of tomatoes at the base of the plant should now be ready for the market. Each season a number of inquiries are received about patchy ripening. This is a problem of nutrition, and may be generally corrected satisfactorily by a dose or two of sulphate of potash at 1 oz. to the square yard. Plants at this stage will require generous feeding to fill out the fruit, and a considerable amount of water in most cases. An average crop may be fed fortnightly now with a solution of superphosphate, sulphate of potash, and nitrate of soda, 1 oz. of the first and $\frac{1}{2}$ oz. each of the others to the square yard. As a rule ventilation should be given at night and increased early on fine mornings. In the close humid weather occurring in some districts the crop should receive all the ventilation possible at this period.

The outside tomato crop, although somewhat delayed in many instances by occasional cold snaps early in the season, will now be well up the trellises, and require constant attention in the way of tying and suckering. Cultivation will also be necessary to keep down weeds and promote growth, but it must be shallow. Quite a number of crops are depreciated each season to the extent of 50 per cent. through deep cultivation, which, instead of promoting growth, seriously dwarfs the plants by interfering with the roots.

SMALL-FRUITS.

The berry harvest will now be at its peak; strawberries, raspberries, and currants will require regular and careful picking to prevent waste. Strawberry-beds that are fruiting must be kept clear of runners, and raspberry crops on land inclined to be light will receive great benefit if they can be irrigated, especially if the weather should happen to be dry.

THE MARKET-GARDEN.

Potato crops in districts subject to late blight should now be sprayed with bordeaux, 4-4-40, repeating the application after an interval of two or three weeks with a slightly stronger mixture. A third application should be made if the conditions are bad.

Good vigorous crops of onions should not be much troubled with mildew, but where this disease prevails some improvement may be obtained by applying sulphide of potassium at 1 oz. to 3-4 gallons of water.

The seedling beds of winter cabbage and broccoli are often attacked with aphids and caterpillars at this season. The remedy is to grow them thinly and vigorously. A spray composed of arsenate-of-lead and tobacco concentrate will free them from these pests; one or two applications at an interval of a week or ten days should be given before they are removed from the seed-beds.

Celery seedlings are now very subject to fungus leaf-blight, which checks the growth and spoils the appearance of the crop. Large clean sticks may only be grown by careful attention to spraying. One or two applications of bordeaux at intervals of a fortnight should be given before the plants are removed from the beds, and continued after they are set out in the field.

In the cooler districts savoys, cauliflower, broccoli, and leeks may now be planted out. Water the beds well the day before the operation. Lift the plants with care and handle them well, using trays for transportation to the field, and protecting them from exposure to sun and wind as far as possible. If drills are drawn with a marker to indicate the rows the planting may be done expeditiously. If the weather is dry they should be watered in. If desired, they may be planted between dwarf peas before that crop is removed. Or an old strawberry-bed will provide excellent conditions for a crop of this kind. Burn off the litter and lightly cultivate the land before planting.

For leeks draw 6-in. drills and set the plants deeply in the bottom. For large tender sticks a rich soil is required. This hardy crop deserves more attention in the colder localities.

Tobacco-culture.

The first batch of tobacco-plants set out in the field will now be reaching maturity, and great care will be needed to prevent damaging the leaf when cultivating. In fact, if the crop is inclined to be coarse it will be as well to discontinue this operation with a view to refining the plants and ripening them off. Towards the end of December they will commence to blossom, and when the majority reach this stage of growth it will be necessary to top them to prevent depreciation of the leaves, which would take place through the blossom taking the sap of the plant to the detriment of the foliage. This is one instance of the economy of an even crop, as the plants then flower at the same time, and topping may be done in one operation instead of a number, as is necessary when the development is irregular.

Just how much to remove when topping requires careful judgment and experience. Supposing it is intended to air-cure the crop, break away the two or three small torn leaves at the base of the plant (the lugs), count ten to twelve leaves up the stalk, and remove the top just above the uppermost. This treatment will meet the average case, but if the weather is moist and the plants vigorous one or two more leaves may be left to absorb the vigorous growth. This will avoid coarseness in the leaf, and reduce the tendency to form unduly strong side shoots ("suckers") in the axils of the leaves. In any case, these will develop to some extent, and must be broken out before they exceed 3 in. in length. It is important to remove all lugs, tops, and suckers to the open space in the middle of the rows so that they may dry out and break up. Careless operators sometimes allow some of them to lie on the growing leaves of the plant, where they do serious damage by causing decay.

If the crop is to be cured in a kiln no priming is done—that is, the lugs are not removed—and the top is taken off at a point where the leaves are of the size of the cherry-laurel. Careful attention to suckering the plants subsequently will be necessary in either case.

—W. C. Hyde, *Horticulturist*, Wellington.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR OCTOBER, 1929.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat recd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.						
		Yrs. days	lb.		lb.	lb
<i>Junior Two-year-old.</i>						
Pukepapa Shirley May	H. Cole, Waitara ..	2 48	245·3	365	9,108·6	605·90
Idalia's King's Princess	T. Wells, Dargaville ..	2 56	246·1	305	8,113·4	565·15
Beechland's Lady Twylish	W. R. Booth, Te Rapa ..	1 354	240·5	354	8,836·1	477·36
Raeburn Poppy Day	J. S. Rae, Taneatua ..	1 233	240·5	346	7,691·9	464·21
Raleigh's Ruby ..	O. McAloon, Te Wera ..	1 230	240·5	365	7,866·2	459·68
Clendon Beauty ..	H. Peoples, Drury ..	1 348	240·5	365	8,438·5	455·34
Pukatea Patricia ..	G. R. Bell, Waipuku ..	1 343	240·5	306	7,465·9	454·37
Coniston Jessamine ..	R. Waterhouse, Papakura ..	2 57	246·2	365	7,381·0	452·80
Solo Bell ..	J. Hampton, Timaru ..	2 82	248·7	312	7,060·8	451·39
Gowanlea White Wings	J. Robb, Wanganui ..	1 362	240·5	365	7,461·9	450·92
Someview Thelma ..	A. E. Phillips, Maunu ..	1 350	240·5	365	7,318·1	447·63
Bethune I.A. Andelusia	A. S. W. Hazard, Waimate N.	2 12	241·7	365	8,963·9	442·59
Linden Grove Dolcebell	G. R. and H. Hutchinson, Auckland	2 34	243·9	365	7,752·0	433·79
Jerseydale Tilly ..	J. Pettigrew, Phama ..	2 4	240·9	363	6,476·8	433·38
Royton Elva ..	A. Moreland and Sons, Te Rapa	2 35	244·0	308	7,331·2	424·44
Raeburn Golden Sunbeam	J. S. Rae, Taneatua ..	2 31	243·6	324	8,720·2	419·10
Raeburn Rainbow ..	J. S. Rae, Taneatua ..	2 21	242·6	335	6,331·8	413·70
Someview Tessie ..	A. E. Phillips, Maunu ..	2 28	243·1	365	8,077·8	411·23
Croydon Charm ..	W. Crosby, Waipuku ..	2 50	245·5	308	6,549·0	410·48
Waif's Fox ..	A. E. Sly, Whakaronga ..	1 307	240·5	332	6,079·0	390·85
Ivry's Quicksilver ..	H. W. Le Bailly, Buckland	2 4	240·9	365	7,021·8	386·80
Raeburn Afterglow ..	J. S. Rae, Taneatua ..	1 140	240·5	346	6,523·0	382·32
Brentwood Emerald ..	C. A. Willis, Pukekohe ..	2 27	243·2	354	7,047·9	382·26
Bride's Wait ..	A. E. Sly, Whakaronga ..	1 364	240·5	314	6,748·6	372·62
Croydon Choice ..	W. Crosby, Waipuku ..	2 38	244·3	296	6,070·6	369·70
Mt. Kowhai Grateful	R. J. Johnston, Runciman	1 286	240·5	365	6,620·0	365·14
Brentwood Freda ..	C. A. Willis, Pukekohe ..	2 53	245·8	342	6,012·1	364·73
Linden Grove Silverlocks	G. R. and H. Hutchinson, Auckland	1 358	240·5	355	6,859·9	362·08
Waitakohe Cleopatra	J. T. Warman, Katikati ..	1 326	240·5	365	6,297·6	361·26
Brentwood Lady Winnie	C. A. Willis, Pukekohe ..	2 8	241·3	349	6,897·8	355·40
Green View Sea Pearl	R. Wattam, Cambridge ..	2 56	246·1	365	7,367·6	353·43
Derry's Lady ..	S. J. Robinson, Matamata ..	1 257	240·5	365	6,256·8	353·21
Hillside Sheila ..	S. J. Robinson, Matamata ..	1 315	240·5	360	5,926·1	349·13
Barnagh Rozel ..	W. T. S. Wilson, Otahuhu ..	2 31	243·6	342	5,757·4	348·35
Joyful Beauty ..	A. E. Sly, Whakaronga ..	2 29	243·4	282	5,287·7	346·08
Llangollen Trixie ..	J. T. Entwistle, Cambridge ..	1 285	240·5	365	5,884·2	333·77
Iron Victress ..	H. W. Le Bailly, Buckland	1 347	240·5	365	5,768·3	318·93
Llangollen Aster ..	J. T. Entwistle, Cambridge	2 3	240·8	353	5,359·6	310·26
Bethune Kathleen ..	A. S. W. Hazard, Waimate N.	1 357	240·5	265	6,950·2	283·05
Passion's Princess ..	H. Naylor, Te Rapa ..	1 341	240·5	331	5,101·3	277·29
Homeside Myrtle ..	H. Rogers, Pukekohe ..	2 0	240·5	325	5,758·7	274·12
Waiora Pretty Bell ..	A. E. Peppercorn, Cambridge	2 30	243·5	345	5,817·3	271·77
Derry's Cute Girl ..	S. J. Robinson, Matamata ..	2 31	243·6	331	4,902·7	271·54
Derry's Princess ..	S. J. Robinson, Matamata ..	1 327	240·5	365	5,365·5	270·61
Golden Favours ..	H. Naylor, Te Rapa ..	2 12	241·7	282	4,293·3	256·38

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

<i>JERSEYS—continued</i>						
<i>Senior Two-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Phantom's Primrose ..	G. S. B. Morrison, Maungatapere	2 249	265·4	365	9,252·1	534·87
Selside Mermaid's Flower	J. Gibson, Stratford ..	2 335	274·0	344	7,876·9	486·04
Silo Dale Gay Girl ..	A. G. Somervell, Takapau ..	2 263	266·8	337	7,601·6	477·85
Waihoehoe Dahlia ..	E. Fielding, Drury ..	2 226	263·1	365	7,463·9	444·67
Raeburn Rosebud ..	J. S. Rae, Taneatua ..	2 352	275·7	364	7,234·8	426·83
Coniston Eminence ..	R. Waterhouse, Papakura	2 137	254·2	365	6,552·1	396·38
<i>Three-year-old.</i>						
Waihoehoe Lily ..	E. Fielding, Drury ..	3 179	294·9	365	9,767·7	579·26
Orange Dale Rower's Queen	W. J. Hall and Son (Estate of), Matatoki	3 251	302·1	365	10,621·0	564·10
Fairy Meadows Goldie	A. Hazelton, Waihou ..	3 318	308·8	361	7,477·8	512·14
Almadale Silver Bowl	H. Rogers, Pukekohe ..	3 8	277·8	365	8,019·3	493·26
Northland Merriment	E. W. Jacobs, Horotiu ..	3 143	291·3	365	10,184·6	486·58
Kahuwera Madge ..	J. V. Mortensen, Pio Pio ..	3 6	277·6	365	8,363·4	481·66
Oxford Dale Plume ..	J. T. Entwistle, Cambridge ..	3 361	313·1	352	7,101·9	474·50
Raeburn Pearl ..	J. S. Rae, Taneatua ..	3 199	296·9	335	9,618·9	472·00
Flat Park Golden Mary	W. J. Hall and Son (Estate of), Matatoki	3 11	278·1	280	8,279·1	437·72
Brooklyn Lady Meg	H. J. Lancaster, Glen Oroua	3 342	311·2	233	7,297·9	420·34
Hostage of Bulls ..	Dr. F. J. Watson, Bulls ..	3 155	292·5	328	7,359·4	358·61
<i>Four-year-old.</i>						
Kahuwera Bo-Peep ..	Messrs. Johnson Brothers, Mangapiko	4 38	317·3	365	10,749·1	680·67
Waihoehoe Rose ..	E. Fielding, Drury ..	4 265	340·0	364	10,576·5	587·04
Kakuwera Anetta ..	J. V. Mortensen, Pio Pio ..	4 337	347·2	365	10,236·4	550·52
Beechlands Bright Lady	A. Moreland and Sons, Te Rapa	4 337	347·2	365	7,214·6	502·89
Silence of Rosy Creek	O. McAloon, Te Wera ..	4 30	316·5	316	8,791·2	488·07
Waihoehoe Violet ..	E. Fielding, Drury ..	4 350	348·5	365	7,115·0	439·28
Breezy's Duchess ..	J. Gibson, Stratford ..	4 342	347·7	307	6,842·0	408·23
Bacchante of Aria ..	M. V. Reeve-Smith, Aria ..	4 291	342·6	304	7,893·9	402·63
Joy's Belle ..	A. G. Brosnahan, Whangara	4 343	347·8	343	8,935·9	398·52
Fairy Meadows Twylish	E. J. Mears, Hamilton ..	4 5	314·0	297	7,413·3	337·95
<i>Mature.</i>						
Connemara's Lady ..	O. McAloon, Te Wera ..	5 7	350·0	353	12,275·9	682·33
Gowanbrae Gem ..	C. G. Stuart, Rockville ..	5 356	350·0	365	12,918·8	632·02
St. Aubin's Gladiolus	J. G. Harvey, Taupiri ..	6 363	350·0	364	11,431·8	627·71
Barnaigh Twylish Lass	W. T. S. Wilson, Otahuhu ..	5 356	350·0	365	9,411·4	607·63
Majestic's Princess ..	W. Hazelwood, Northcote	6 343	350·0	360	10,342·8	572·13
Tulip's Minta May ..	H. Cole, Waitara ..	5 319	350·0	304	9,972·6	554·25
White Satin ..	E. Fielding, Drury ..	13 13	350·0	365	10,465·6	556·83
Lady Caius of Inaha	O. Sutton and Sons, Richmond	6 11	350·0	365	11,908·8	549·50
Springlea Sweet ..	Mrs. I. W. Speirs, Levin ..	5 323	350·0	353	10,231·5	545·45
Waihoehoe Aster ..	E. Fielding, Drury ..	5 180	350·0	323	8,842·9	519·30
Marshlands Butterfly	Truby King, Stratford ..	5 26	350·0	305	7,560·2	478·25
Heathcote Morning Glory	Mrs. E. E. Norton, Waimauku	6 303	350·0	355	8,310·1	455·00
Waihoehoe Natalie ..	E. Fielding, Drury ..	5 242	350·0	307	9,404·8	452·54
Kapuna Lady ..	J. Davies, Maxwelltown ..	5 53	350·0	296	8,484·0	421·65
Pride's Fortune ..	J. T. Entwistle, Cambridge	6 355	350·0	312	7,849·0	414·43
Hope's Mermaid ..	A. E. Sly, Whakaranga ..	6 363	350·0	338	8,015·9	404·54

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat

FRIESIANS.						
<i>Junior Two-year-old.</i>		Yrs	dys.	lb.	lb	lb.
Pareora Echo Pearl*	C. J. Neville, Clandeboye ..	2	84	248·9	328 12,647·5	526·59
Totara Sylvia Beatus*	Piri Land Co., Auckland ..	2	153	255·8	365 14,186·8	504·43
Pareora Echo Posch*	A. S. Elworthy, Timaru ..	2	91	249·6	365 14,252·2	464·31
Totara Matador Echo*	Piri Land Co., Auckland ..	1	329	240·5	365 12,261·1	428·18
<i>Senior Two-year-old.</i>						
Totara Sylvia Lass*	Piri Land Co., Auckland ..	2	276	268·1	365 19,006·1	690·02
Totara Sylvia Trixy*	Piri Land Co., Auckland ..	2	198	260·3	365 17,942·6	606·24
Rosevale Sylvia Nancy*	G. G. McRae, Waimate ..	2	315	272·0	365 12,632·6	445·28
Totara Tehee Paxton*	Piri Land Co., Auckland ..	2	262	266·7	365 13,682·0	433·02
<i>Junior Three-year-old.</i>						
Totara Sylvia Colantha*	Piri Land Co., Auckland ..	3	149	291·9	365 17,510·1	594·64
<i>Junior Four-year-old.</i>						
Grebegga of Royal Vale	H. H. Hicks, Turua ..	4	30	316·5	351 11,695·3	403·11
<i>Mature.</i>						
Glen Iris Ruby* ..	Wesley Training College, Paerata	6	275	350·0	365 18,222·9	638·14
Bloomfield Fayne De Kol*	Piri Land Co., Auckland ..	6	277	350·0	365 18,015·5	574·63
Hengerveld Rongotea Sunbeam	P. Hodder, Carterton ..	5	96	350·0	348 14,697·2	506·31
MILKING SHORTHORNS.						
<i>Senior Three-year-old.</i>						
Pukerimu Cherry 5th	Fisher Bros., Pukerimu ..	3	296	306·6	339 8,872·9	343·29
<i>Mature.</i>						
Riverdale Florrie 2nd	T. W. Wardlaw, Waimana ..	..	..	350·0	365 17,359·6	761·17
Bushcroft Matangi Pet 2nd	H. Bond, Rangiotu ..	9	2	350·0	318 10,056·1	412·31
AYRSHIRES.						
<i>Mature.</i>						
Elims Paeony ..	A. R. Claridge, Toko ..	..	..	350·0	337 12,430·7	508·18
Elims Flora ..	A. R. Claridge, Toko ..	7	309	350·0	365 11,023·1	412·15
<i>Second-class Certificates</i>						
Friesians.						
<i>Mature.</i>						
Ryvington Pontiac Duchess	T. P. Hodgson Estate, Tama- here	5	364	350·0	365 15,296·5	598·43

Liver-fluke in Sheep.—The annual report of the Live-stock Division for 1928-29 states that there has been a considerable improvement in the affected areas of the Hawke's Bay District as regards this trouble. Much good work in eradicating the water-snail host has been undertaken by the farmers, with satisfactory results. During the year investigations showed that liver-fluke is more prevalent in the Gisborne district than was supposed. Whenever fluke is found, instruction and advice, with a view to prevention, is given in all cases.

WEATHER RECORDS : OCTOBER, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THE month of October was notable for the exceptionally dry conditions experienced over nearly the whole of the Dominion. A few places from Auckland northwards had an excess, and in the East Cape, Gisborne, and Napier districts—more especially the coastal portions—the average was also exceeded; but elsewhere in the North Island and the whole of the South Island recorded below normal falls. Oamaru had only 5 points, which is the lowest month's total ever recorded there. In the east coast provinces of the South Island and Otago generally the deficiencies were considerable, and this, combined with the cold temperatures experienced, severely retarded the growth of vegetation.

Throughout the country districts in the South Island the backwardness of the season was clearly evident, and feed on well-stocked land was rather scarce in some cases. In the North Island there were more days on which rain fell, and the scarcity of feed was not so apparent, so that usually stock kept in good condition, although feed was rather short for cattle.

Temperatures were, on the whole, below average, and there were rather more frosts than is usual at this period, those on the 15th and 25th doing some damage to early-sown crops.

From the 1st to the 7th, and again from the 10th to the 17th, fine weather was experienced, practically generally under the influence of well-developed anticyclones. The remainder of the month, however, except for occasional brief intervals, was subject to changeable and unsettled conditions.

On the 8th the front of a vigorous depression moved on to southern New Zealand while a cyclone was passing to the northward. Strong east winds prevailed at this time north of Auckland, with some rain. Unsettled conditions gradually became general with the advance of the southern depression, and on the 9th rain fell in most districts, but in the South Island the falls were only light and scattered. Motu, in the Gisborne district, had as much as 421 points on the 9th. The passage eastwards of this depression brought a cool southerly change during the night of the 10th.

The most severe weather during the month was that experienced during the 23rd and 24th, and was associated with an intense cyclone. The latter had moved slowly from the New South Wales coast on to the central Tasman Sea, but from the 22nd it made more rapid progress, and by the night of the 22nd had moved on to northern New Zealand. General rain fell in connection with this disturbance, except in Westland, where fine weather continued to prevail. By 9 a.m. on the 23rd winds had changed to south-east or southerly south of New Plymouth and East Cape, with a considerable drop in temperature, and on the 24th southerlies were prevailing generally, with strong gales in and north of Cook Strait. Exceptionally heavy rain fell at this time in the Auckland, Gisborne, and Hawke's Bay districts. On the 22nd a violent hailstorm occurred at Waipawa.

Considerable damage was done by the south-east gale at New Plymouth on the 24th, iron roofs being twisted and trees uprooted, while two partially built houses were demolished.

Fairly general rain fell also on the 31st while a double-centred disturbance was crossing the Dominion. One of the centres was located west of the North Island, and during the night of the 31st it was responsible for stormy conditions in parts of Auckland Province. Its effects were particularly severe in the Riverhead, Kumeu, and New Lynn districts, and in some places thunderstorms were experienced accompanied by very heavy rain.

Although there were short periods when the winds were severe, on the whole there was a relative absence of strong winds during the month.

RAINFALL FOR OCTOBER, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitia	3·04	14	1·01	4·48
2	Russell	4·00	11	1·03	4·64
3	Whangarei	5·86	13	2·14	4·96
4	Auckland	5·05	13	2·38	3·64
5	Hamilton	2·91	12	0·90	4·79
5A	Rotorua	4·49	10	1·46	5·25
6	Kawhia	2·01	6	1·04	5·48
7	New Plymouth ..	2·66	9	0·86	5·61
8	Riversdale, Inglewood ..	4·14	15	1·31	10·37
9	Whangamomona ..	4·04	8	1·03	9·01
10	Eltham	2·30	9	0·72	4·11
11	Taurua	4·10	10	0·94	6·46
12	Tauranga	4·63	11	0·77	5·25
13	Marahako Station, Opotiki	7·94	12	2·08	5·45
14	Gisborne	4·10	11	2·23	2·80
15	Taupo	3·15	8	0·93	4·48
16	Napier	2·80	10	1·43	2·30
17	Maiaekakaho Stn, Hastings	2·03	13	0·85	3·09
18	Taihape	0·71	9	0·23	3·99
19	Masterton	1·98	10	1·06	3·32
20	Patea .. ..	..	..	..	4·33
21	Wanganui	0·39	4	0·16	3·67
22	Foxton	0·83	6	0·38	2·92
23	Wellington (Karori Reservoir)	2·50	15	1·12	3·83
<i>South Island.</i>					
24	Westport	3·60	11	1·19	6·97
25	Greymouth	6·38	11	2·10	10·03
26	Hokitika	7·57	11	2·08	11·84
27	Ross	8·87	10	1·86	15·10
28	Arthur's Pass .. ..	..	..	..	10·78
29	Okuru	12·61	9	4·44	15·37
30	Collingwood .. ..	..	..	..	11·03
31	Nelson	1·63	6	1·01	3·59
32	Spring Creek, Blenheim ..	1·29	7	0·42	2·72
33	Tophouse	2·07	8	0·90	5·90
34	Hanmer Springs	1·93	14	0·53	3·31
35	Highfield, Waiau	0·90	5	0·42	2·60
36	Gore Bay	0·32	3	0·12	2·25
37	Christchurch	0·05	4	0·02	1·68
38	Timaru	0·14	4	0·04	1·95
39	Lambrook Station, Fairlie ..	0·10	2	0·06	2·01
40	Benmore Station, Clearburn	0·12	3	0·08	2·13
41	Oamaru	0·05	3	0·03	1·68
42	Queenstown	0·97	2	0·94	3·48
43	Clyde	0·03	1	0·03	1·58
44	Dunedin	0·40	7	0·15	3·09
45	Wendon	0·53	4	0·21	2·66
46	Gore	0·46	9	0·15	3·26
47	Invercargill	0·66	11	0·16	4·44
48	Puysegur Point	4·16	19	0·90	8·16
49	Half-moon Bay	2·35	13	0·59	4·94

—Edward Kidson, Director of Meteorological Services, Wellington, 6/11/29.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ARTHRITIS IN LAMBS.

M. G., Mangorei Road, New Plymouth:—

Can you give me advice about a complaint attacking young lambs here? Some five or six young lambs in my neighbour's small flock, when only a few days old, have become unable to use their legs. The knee-joints are affected and swollen, the complaint travelling from one leg to another. Some of the sufferers have died, others are lying about being fed as pets, and only one has so far improved sufficiently to walk again.

The Live-stock Division:—

The trouble affecting the lambs is what is commonly known as arthritis. This is the term applied to inflammation of one or more joints, usually associated with a certain amount of pus-formation in the joint. The infection may gain entrance either through the unhealed umbilicus (navel) at time of or immediately after birth, or in the case of older lambs through the wounds resulting from tailing operations. The complaint is comparable to joint-ill or navel-ill in foals. Any lambs dead from arthritis—in fact, all carcasses of animals dying from any cause—should be burned or buried deeply in lime to prevent contamination of the surface soils and pastures. The bacteria responsible for this trouble have a special affinity for settling in joints of the new-born, the joints most commonly affected being the knee, hock, and stifle. Ewes about to lamb should be placed in a clean paddock, as free as possible from contamination of any previous animal affected with disease. At time of marking and tailing the knife used requires to be sterilized by boiling, and during the operations the use of reliable antiseptics is recommended. The use of temporary yards for these operations—selecting a fresh, clean site each year—is also to be commended.

PREPARING TOBACCO FOR SMOKING AND SPRAY.

O. T. K., Otaki:—

Kindly give me directions for curing small quantities of tobacco for smoking, also for making a nicotine spray.

The Horticulture Division:—

Small quantities of tobacco should be cured in a ventilated shed in the manner described in the Department's Bulletin No. 137. Then, as there will be an insufficient quantity to bulk in the usual way, the leaves when soft should be stripped from the stalks and tied into "hands." These should be packed in a case of suitable size, and a few boards placed on top with a moderate weight to compress the leaf as it subsides. Examine the package occasionally for a week or two to see that it does not overheat. If the temperature rises over 80° F. the material should be taken out, aired a little, and repacked. In six months or so the tobacco may be used, but it will improve if kept in this way for two years. Keep the parcel in a moderately warm room.

To make tobacco-wash for spraying, chop the waste up small, and, if possible, put it through a mill. Then take 2 lb. of the dust, 7 oz. of quicklime, and 3 gallons rain-water. Slake the lime and pour the milk into the water. Stir in the tobacco-dust and let it stand thirty-six hours, stirring it twice a day. Then strain it through some coarse sacking, and wash the residue until the volume of liquor measures 3 gallons. Add an equal quantity of water, making it up to 6 gallons, and apply.

" BLOWING " OF COWS ON SPRING PASTURE.

A. R. H., Feilding :—

Of late our nine cows, which have been running on 7 acres of rich land, have been troubled with blowing. This pasture was heavily top-dressed with basic slag last year and with superphosphate this year. Naturally there is an abnormal growth of white clover and rye-grass. One cow blew itself several times and has since died, and now a heifer is troubled. At that time the cows were only there in the daytime, so now we are keeping them there the whole time, but the same heifer was blown to-night. Do you think the top-dressing has anything to do with the matter? And could you send me a remedy at your earliest convenience, as we wish to prevent them from blowing as soon as possible?

The Live-stock Division :—

It is admitted that anything which tends to produce a surplus growth of white clover in early spring pasture increases the tendency to cows becoming "blown." The trouble arises most readily when the animals' stomachs are in a partially distended state before being put on the clover, consequently the obvious preventive is some hard, dry feed before ingestion of the clover. In order, therefore, that the beneficial results of the spring feed should not be lost to milk-production, judicious rotation of grazing is necessary. In practice the use of a night paddock, feeding out hay overnight, and placing the cows on clover only when the dew is well off in the morning, is probably the best method. (The risk is greatly increased if the growth is laden with moisture.) Cows on clover must be carefully watched when first put on. It is better only to allow a short period of grazing to begin with, increasing as the feed is being tolerated. Regarding the immediate treatment of "blown" cows, a drench composed of one wine-glassful of turpentine shaken up in a pint of raw linseed-oil is probably as good as any other remedy. In very acute cases, in which there is danger of suffocation, puncture of the paunch must be resorted to. This is performed on the left side, the puncture being made at a point equidistant from the last rib and the paunch-bone. If a trocar and cannula are not available, a long narrow-bladed knife can be used, which should be frequently turned in the wound to allow exit of gas.

BEEKEEPING INQUIRIES.

T., Richmond :—

Would you please give me information as follows: Is the Deadman super-cleaner system still in use at the Government apiary? Is it a safe system for a beginner, and what are its disadvantages? Of what use, if any, is the common gorse-flower to bees, and does it give marketable honey?

The Horticulture Division :—

The Deadman super-cleaner system is not now in use in the Government apiary. It is not regarded as a safe system for a beginner to use, the chief disadvantage being that in the cooler climates the bees will not readily leave the super when this method is employed. In New Zealand gorse is of value to the beekeeper in its pollen only. It does not secrete honey in marketable quantities.

Control of Red Mite on Apple-trees.—Mr. G. Stratford, Orchard Instructor, Motueka, reports that tests carried out with summer spraying-oil during last season were very successful in the control of red mite. He remarks: "Spraying was done the first week in February at strength 1-100, the result being a good kill with practically no spotting of the fruit. A later spray on Delicious cleaned the trees well, there being no necessity to clean the fruit when grading for export. From these results I am prepared to recommend two sprayings this season—one towards the end of January, and another towards the end of February."

SEEDS IMPORTATION REGULATIONS.

REGULATIONS under the Seeds Importation Act, 1927 (revoking the regulations of 28th April, 1928), were gazetted on 17th October, 1929, as follows:—

1. (1) These regulations may be cited as "The Seeds Importation Regulations, 1929." (2) These regulations shall come into force on the date of publication in the *Gazette*, but shall not apply to any seed that may then be in transit to the Dominion. (3) For the purposes of these regulations, unless the context otherwise requires, "import" includes attempting to import or being concerned in importing; "seed" means cocksfoot (*Dactylis glomerata*), lucerne (*Medicago sativa*), or white clover (*Trifolium repens*) seed, or any other seed declared by the Governor-General in Council to be subject to the provisions of the said Act; "Inspector" means any person appointed as Inspector for the purposes of the said Act.

2. (1) Not less than one per centum of each package of cocksfoot-seed and not less than ten per centum of each package of all other seed imported into New Zealand shall be stained prior to importation with a red colouring-matter. (2) The colouring-matter to be used shall be either an alcoholic solution of saffranin or a specially prepared and effective fluid seed-staining dye. (3) Staining shall be done in the case of cocksfoot-seed by mixing not less than one per centum of the bulk and in the case of all other seed by mixing not less than ten per centum of the bulk with the stain, and then blending the stained parcel with the bulk lot.

3. (1) The form of certificate required by subsection (2) of section 5 of the said Act shall be in the form set out in the First Schedule hereto. (2) The certificate shall be in duplicate. One copy shall be retained by the importer at the port of entry, and the other shall be supplied by him to the Inspector, who shall, on being satisfied that the seed covered by the certificate has been effectively stained in the manner prescribed in these regulations, issue a permit in the form set out in the Second Schedule hereto for the seed to be landed.

4. The following shall be the only ports of entry for seed: Auckland, Wellington, Tyneltton, Gisborne, Napier, New Plymouth, Dunedin, Port Chalmers, Bluff, Timaru, Wairau (including Picton), Oamaru, Wanganui.

5. Every person who imports or attempts to import, or is concerned in importing, any seed in contravention of these regulations commits an offence, and is liable to a fine not exceeding twenty pounds.

ARECOLINE HYDROBROMIDE FOR DOG TAPEWORMS.

IN connection with the campaign against hydatid disease, arecoline hydrobromide in tabloid form in suitable doses for dogs is now being put up by Kempthorne, Prosser, and Co. Those requiring this very reliable drug, the use of which was described in last month's *Journal*, should obtain supplies through their chemist or direct from Kempthorne, Prosser, and Co.

Fumigation of Imported Tree-seed.—"After a two-years trial" (says the annual report of the State Forest Service for 1928-29) "it has been found that, with the exception of formalin solution, the fumigation of tree-seed by chemicals has no appreciable harmful effect on subsequent germination, but in some cases appears to increase it. Formalin solution was found to be universally injurious to the germination of all five species which were treated. Carbon bisulphide increased the germination in four out of six species dealt with; this chemical is easy to apply and is also an effective insecticide. Gas fumigation with a mixture of potassium permanganate and formaldehyde, and also treatments with solutions of mercuric chloride and of sulphuric acid, showed no appreciable harmful effects either on the germination or on the subsequent growth of the seedlings. As a result of this study and of correlated studies carried out by the Forest Entomologist, all seed imported by the Service is at once subjected to fumigation with bisulphide of carbon as a matter of ordinary routine. Risk of importation of seed-feeding insects is thus entirely eliminated, without detriment to seed-viability."

IMPERIAL AGRICULTURAL RESEARCH BUREAUX.

FOLLOWING the decision of the Imperial Agriculture Research Conference of 1927, a number of research bureaux have recently been set up to act as clearing-houses of information for various branches of investigation conducted in different parts of the Empire. The personal acting link in each Dominion is the local correspondent, and as regards New Zealand the Government—per medium of the Department of Scientific and Industrial Research—has now appointed such correspondents. The various bureaux established, together with their respective headquarters, directors, and New Zealand correspondents, are as follows:—

Animal Nutrition.—Rowett Institute, Aberdeen: Dr. J. B. Orr, director; Mr. B. C. Aston, Chief Chemist, Department of Agriculture, Wellington, local correspondent.

Soul Science.—Rothamsted Experimental Station, England: Sir John Russell, director; Mr. T. Rigg, Cawthron Institute, Nelson, local correspondent.

Animal Genetics.—Animal Breeding Research Department, Edinburgh University: Professor F. E. Crew, director; Professor W. Riddet and Dr. F. W. Dry, Massey Agricultural College, Palmerston North, local correspondents.

Agricultural Parasitology.—Institute of Agricultural Parasitology, St. Albans, England: Professor R. T. Leiper, director; Mr. C. S. M. Hopkirk, Veterinary Laboratory, Department of Agriculture, Wallaceville, Wellington, and Dr. D. Miller, Cawthron Institute, Nelson, local correspondents.

Plant Genetics (Herbage Plants).—Welsh Plant Breeding Station, Aberystwith, Wales: Professor R. G. Stapleton, director; Mr. E. Bruce Levy, Agrostologist, Plant Research Station, Palmerston North, local correspondent.

Fruit Production.—East Malling Research Station, Kent, England: Mr. R. G. Hatten, director; Mr. J. A. Campbell, Director, Horticulture Division, Department of Agriculture, Wellington, local correspondent.

Plant Genetics (other than Herbage Plants).—Plant Breeding Institute, Cambridge University, England: Sir Rowland Biffen, director; Dr. F. W. Hilgendorf, Canterbury Agricultural College, Lincoln, local correspondent.

Animal Health.—Veterinary Research Laboratory, Weybridge, England: Dr. W. H. Andrews, director; Mr. C. S. M. Hopkirk, Veterinary Laboratory, Department of Agriculture, Wallaceville, local correspondent.

The establishment of a Bureau of Economic Botany is at present under consideration, and Dr. H. H. Allan, of the Plant Research Station, Palmerston North, has been nominated as local correspondent.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 19th September to 31st October, 1929, include the following of agricultural interest:—

No. 62577: Teat-cup of milking-machine; G. Powell, jun., Orini R.D. No. 63255: Disk plough; F. G. Harris, Mount Bauple, Q. No. 63235: Tractor-wheel grip; A. M. McGregor, Parkes, N.S.W. No. 62987: Grading eggs; I. M. Cowan, Bondi, N.S.W. No. 63144: Wire-fence dropper; Corkscrew Fences, Ltd., Sydney, N.S.W. No. 63175: Sledge; H. J. and H. G. Sampson, Ngaruawahia. No. 63283: Potato-grading machine; G. J. Bevington, Rangiora. No. 63363: Preservation of meat; S. H. Higgs and E. P. O'Donnell, Wellington. No. 60926: Flax-stripper; J. E. Holland, Christchurch. No. 61460: Wire-strainer; N. L. de Lantour, Matawai. No. 61480: Cream-can cover; A. J. Squire, Kaikohe. No. 61839: Manure-distributor; E. I. Bullot, Waipuku. No. 60885: Plough-raising means; J. Henry, Loburn. No. 62386: Hay-stacking means; H. D. Sorensen, Paeroa. No. 63500: Cultivating implement, C. W. Winder, Wharepoa. No. 63566: Fencing-standard; W. J. S. Jones, Sydney, N.S.W.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

THE SEASON'S LAMBING : NORTH ISLAND ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 87.56 per cent., compared with 84.61 per cent. last year. With 8,820,536 breeding-ewes in the North Island, as shown in the 1929 sheep returns, the number of lambs this season is estimated at 7,723,523. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

THE following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 6th November, the figures being based on a card census : Wheat, 234,500 acres ; oats, 275,000 acres ; barley, 20,500 acres. The corresponding final totals for the preceding season (1928-29) were 257,873 acres of wheat, 283,133 acres of oats, and 19,840 acres of barley. Wheat, therefore, has an estimated decrease in area this season of 23,373 acres, oats a decrease of 8,133 acres, and barley an increase of 660 acres.

Also from a card census and at date 6th November the Statistician estimates this season's area under potatoes as 22,600 acres. The corresponding final figures for the 1927-28 season were 21,304 acres. Only holdings of 1 acre and over outside borough boundaries are covered by these figures ; a fair aggregate area of potatoes is also grown on smaller holdings and within boroughs. Reckoned on the average of the last five seasons -5.49 tons per acre—the total yield from this season's area would be 124,000 tons, as compared with a total actual yield of 123,607 tons for 1928-29.

AGRICULTURAL SHOWS, SEASON 1929-30.

THE following show-dates have been notified by agricultural and pastoral associations :—

North Otago A. and P. Association : Oamaru, 21st and 22nd November.

Nelson A. and P. Association : Richmond, 22nd and 23rd November.

Otago A. and P. Society : Dunedin, 26th and 27th November.

Stratford A. and P. Association : Stratford, 27th and 28th November.

Southland, A. and P. Association : **Royal Show**, Invercargill, 10th, 11th, and 12th December.

Helensville A. and P. Association : Helensville, 29th January.

Opotiki A. and P. Association : Opotiki, 1st February.

Whakatane A. and P. Association : Whakatane, 5th February.

King Country A. and P. Association : Te Kuiti, 6th February.

Rodney Agricultural Society : Warkworth, 8th February.

Te Puke A. and P. Association : Te Puke, 8th February.

Dannevirke A. and P. Association : Dannevirke, 11th and 12th February.

Tauranga A. and P. Association, Tauranga, 11th and 12th February.

Masterton A. and P. Association : Solway, 18th and 19th February.

Katikati A. and P. Society : Katikati, 19th February.

Auckland A. and P. Association : Auckland, 27th February to 1st March.

Taranaki Agricultural Society : New Plymouth, 5th and 6th March.

Morrinsville A. and P. Society : Morrinsville, 12th March.

Methven A. and P. Association : Methven, 29th March.

The New Zealand Journal of Agriculture.

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No. 6.

STRAIN INVESTIGATION RELATIVE TO GRASSES AND CLOVERS.

(Continued from July.)

E. BRUCE LEVY, Agrostologist, and WM. DAVIES,* Plant Geneticist, Plant Research Station, Palmerston North

(2) Cocksfoot (*Dactylis glomerata*).

COCKSFOOT occupies a place among pasture grasses second in importance to perennial rye-grass. We hold that the ideal in grasslands is a mixed sward with perennial rye-grass as the dominant species. Cocksfoot ranks as an associate species to perennial rye-grass, and when kept as such by judicious management the pasture as a whole functions at its best as a grazing and milk-producing pasture. Dominant cocksfoot pastures are excellent, of course, but an increasing dominance of cocksfoot must be regarded as a falling away from the possible ideal.

In the earlier days of grassland farming in New Zealand cocksfoot was acclaimed "king of the grasses." In those days, when rough feed characterized our grasslands—associated with cocksfoot-seed production, then so common over many areas that to-day never see the reaping-hook, when milk production and fat-lamb production ranked second to beef, hides, and wool, and when the call for higher production per acre was not so insistent, then did cocksfoot rear above all other species as a veritable king among them. Conditions on the farm have since changed. Our ideas in regard to herbage utilization and what constitutes good pasture-management have been modified. The production of milk and fat lambs calls for young grass—for a mixed pasture of grass and clover, shorter and sweeter, more palatable, and more perfectly balanced as a food ration. This has tended to create a condition prejudicial to the maximum development of cocksfoot, and to-day it must be placed second to perennial rye-grass.

Cocksfoot is essentially a top grass—a shade-endurer and a shade-demander. Its life-form is essentially a tussock. In the making of a

* Member of staff of the Welsh Plant Breeding Station, Aberystwyth, seconded to the New Zealand Plant Research Station for a period of two years.

sward our aim is to suppress the tussock form and make of cocksfoot a turf grass—which, we add, is cocksfoot's undoing. The suppression of the natural growth-form mitigates against the optimum development of this grass, and for this reason the normal commercial type of cocksfoot never shows to the same advantage in what is considered a well-grazed, well-utilized sward as it does where rank growth predominates. Rough growth provides the all-essential shade to the crown, and protects from sun and wind the basal portions of the shoot from whence new roots arise. This may at first sight appear an insignificant detail, but upon the production of these new roots in every growing-season depends the subsequent growth of the plant. In short pastures, and particularly under close and continuous grazing, this new root-system does not develop to anything like the same extent as in the case of rank growth where the crown is shaded and where the base of each shoot is wrapped by dead leaf-bases that hold the moisture and thus set up good rooting-conditions. Where the wind and the sun get right to the crown the bases of the shoots dry rapidly, new roots cannot form, and before long the old roots cease to function and die, with the result that these cocksfoot-plants lose their grip of the soil and are readily pulled out or knocked out by the grazing and treading of animals. The closely grazed open turf is much more fatal to cocksfoot than is the dense turf where rye-grass, white-clover, and crested dogstail abound. These associate species help to shade the crown of the cocksfoot-plant.

We venture to say that cocksfoot of all grasses calls for the greatest skill in the adjustment of the habitat and in the selection of type so that optimum value from this species may be secured by the farmer whose main object is the production of milk or mutton. On grazing-runs, and for those other areas where rough winter feed cured *in situ* is an essential part of farming, cocksfoot is extremely valuable. Dairy cows turned on to the hills among rank cocksfoot winter well on it, and for the ordinary cattle of the run there is perhaps nothing better than a rough hillside of cocksfoot for the winter. On the dairy farm where dry autumns are often experienced and where rye-grass has not a long summer-growth period (one great weakness of rye-grass) cocksfoot fills that summer and autumn breach better than any other species, with the exception of *paspalum* in Auckland Province. Because of this period cocksfoot is necessary in the mixture, but at the same time it must be remembered that one of the finer points in grassland farming is to learn how to so manage the pasture as to retain cocksfoot but yet keep it in control, so that perennial rye-grass and white clover are dominant for as many months in the year as possible.

In soil-fertility requirement cocksfoot occupies a position in the scale just below rye-grass. Hence on those soils incapable of supporting rye-grass, and during those low-fertility periods of the year caused by drought conditions, cocksfoot fills an important and an essential place.

STRAIN IN RELATION TO COCKSFOOT.

From the foregoing it will be seen that cocksfoot is essential to the grasslands of New Zealand as a whole, and the question that strain work opens up is whether the best type of cocksfoot that can be secured is being employed for the more intensive grass-farming. For rough



FIG. 1. DANISH COCKSFOOT: SINGLE PLANTS SHOWING STALKY, ERECT TYPE.
Note earliness of flowering Compare Figs. 2 and 3 taken on same date.



FIG. 2. INTERMEDIATE TYPE OF COCKSFOOT: SINGLE PLANTS SHOWING
DENSE LEAFY FORM.

This type is commonly found in Akaroa cocksfoot. Compare Fig. 4.

[Photos after R. G. Stapledon, *Journal of Ecology*.



FIG 3. DENSE PASTURE COCKSFOOT: SINGLE PLANTS FROM SELECTIONS AT ABERYSTWYTH OUT OF OLD-ESTABLISHED PASTURES.

Note extreme density of leafage, low proportion of stalk, and lateness to flower. Compare Fig. 1.

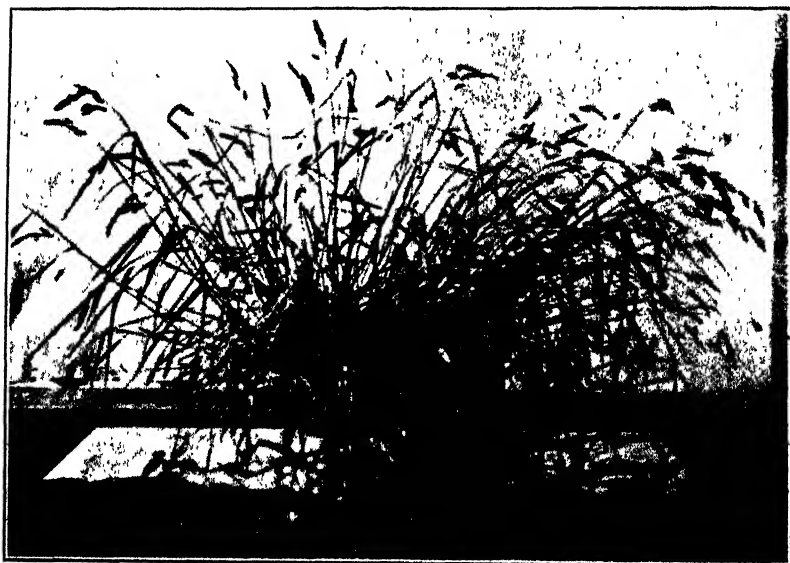


FIG. 4. UNDESIRABLE TYPE OF COCKSFOOT MET WITH IN SAMPLE OF NEW ZEALAND ORIGIN.

The aim of the plant-breeder is to cull out these undesirable types and to select only the best. Compare Fig. 2.

[Photos after R. G. Stapledon. *Journal of Ecology*.

rank feed the question of strain in cocksfoot is probably not important, but we are of the opinion that rotational grazing with full utilization and the more general exploitation of young grass have come to stay. These practices are essentially linked up with maximum production from grassland.

This better utilization, this tendency to suppress seed and stem production, to feed pastures more adequately by regular and systematic manuring, and to extend the profitable life of pastures, calls for an entirely different type of cocksfoot to that which thrives under rough and rank growth conditions. What is required for the grazed pastures of to-day is a dense, multitillered, low-set crowned, leafy rather than stemmy type—one that can thrive, blend in with, and contribute in season its quota of feed as an associate plant in the ideal rye-grass and white-clover pasture. The master factor, however, is persistency and the ability to perennially reproduce by vegetative tillering rather than by annual reseeding. Ability to withstand heavy punishment, such as by grazing and treading, is also a factor of importance. In this respect cocksfoot as a species does not equal perennial rye-grass, but there are types of cocksfoot which show the ability to withstand heavy intermittent grazing while still retaining their place in the pasture.

These latter forms of cocksfoot are in extreme cases very shy seeders. Many forms produce abundant seed, but yet are characteristically persistent, long-lived, and leafy rather than stemmy. These leafy persistent forms help to widen the habitat range of the species, particularly in the direction required. Under a system of intermittent grazing they are able to outyield the short-lived types on all soil-conditions. On really good soils they may hold indefinitely in association with rye-grass, crested dogstail, and white clover, and under properly controlled grazing they have a place in such swards, augmenting the autumnal growth in particular, and under good management will not compete adversely with their associate species. On the less fertile soil-types they can persist for a number of years, will tide over conditions of temporary starvation, and with a subsequent increase in fertility are able to regain their proper position in those swards.

Strain differences in cocksfoot of different origin were noted many years ago by agricultural workers. The late Professor Gilchrist, in England, for example, showed that New Zealand cocksfoot as a type was more lasting than the Danish strain. More recently Professor Stapledon* has made a complete systematic survey of this species, and while confirming the work of Gilchrist, so far as that went, has further shown that cocksfoot can be classified into a number of growth-forms or ecotypes (Figs. 1-4). All commercial lines of cocksfoot can be placed in one or other of several groups. Danish, French, and American cocksfoot, for example, are generally of one type, and are characteristically short-lived forms of the species. These are often heavy seed-producers, and always bear a high proportion of stalk and a correspondingly low proportion of leafage. As pasture plants these types fall short of our ideal. New Zealand cocksfoot, on the other hand, is a different type; it is more persistent, more dense at the crown, has the crown well down to the surface soil, is multitillered, producing a high proportion of leafage,

* STAPLEDON, R. G., Cocksfoot-grass (*Dactylis glomerata*). Ecotypes in Relation to the Biotic Factor. Journ. Ecol. 16, 1928.



FIG. 5. DANISH COCKSFOOT, SHOWING COARSENESS OF LEAF AND GENERAL APPEARANCE IN MOWN SWARD.

The shoots tended to remain prostrate all winter ; the crowns are few-tillered and tend to be raised.



FIG. 6. NEW ZEALAND COCKSFOOT SHOWING FINER LEAF AND MORE TILLERS TO THE CROWN, TENDING TO BE DEEPER SET THAN THE DANISH (FIG. 5).

[Photos by E. Bruce Levy.

and as a type is more suitable for grazing than cocksfoot from other commercial sources. Akaroa (N.Z.) cocksfoot must, however, be looked upon as a mixture of widely differing strains. True, the bulk of these are good pasture strains, but there are included also some types which are altogether less desirable for use in permanent pasture mixtures. There is room, therefore, for systematic plant-selection in cocksfoot, as was shown in the case of rye-grass in the preceding article of this series.

STRAIN TRIALS AT THE PLANT RESEARCH STATION.

One hundred and nineteen lines of cocksfoot are being grown on the Plant Research Station area at Palmerston North. These have been largely drawn from commercial sources, and a few are of special pedigree lines from Great Britain. The outstanding feature of this trial at the present time is the marked difference between Danish cocksfoot and average New Zealand lines (Figs. 5-7). These plots stand out quite distinctly, and the relation between the stands of New Zealand cocksfoot on the one hand and the Danish type on the other is the difference respectively between success and failure so far as a grazing-pasture is concerned. New Zealand cocksfoot grew well right through last winter (Fig. 8), and produced a fair amount of leafage, typically light green but quite a healthy colour. There was very little sign of leaf-burn* except on the Danish plots, where a considerable proportion of the leafage browned off. The winter growth-form and colour of the Danish plots were very characteristic, being glaucous green in colour, few-tillered, and open at the crown; the tillers are coarse and tend to lie flat on the ground, this latter character being partly due to the thinness of the plots in comparison with those of the denser Akaroa type. Virtually no growth was made by the Danish cocksfoot from the end of April to the beginning of August (Fig. 8). Growth commenced early in August, but this has been mainly concerned in the production of stem and flowering-shoots. By the end of October quite an appreciable number of flower-heads had appeared (Fig. 9). The New Zealand type at that time was still showing high leaf-production, with scarcely any tendency to run to seed (Fig. 10). In mid-November portion of each plot was cut at the hay stage. The aftermath showing on 1st December further emphasized the value of the Akaroa type as against the Danish; Akaroa was recovering well, but recovery of the Danish was poor. There is absolutely no doubt on the evidence of the trials concerned of the inferiority of Danish cocksfoot for New Zealand conditions. The trials are in full support of evidence collected elsewhere in New Zealand, substantiating the work of Hilgendorf at Canterbury Agricultural College, and are supported by similar trials conducted in Great Britain.

With a view of making a rapid survey of cocksfoot used in New Zealand, and to find out as soon as possible the relative life of each type under pasture conditions, a section of each plot at the Plant Research Station area is being cut back with a lawn-mower once every week. This treatment has only been in operation for about six months,

* Winter burn or browning in pasture plants is apparently a physiological reaction assumed by the plant to tide over period of adversity. The general indications are that the more hardy strains within any species are the least winter-burned. (See Stapledon and Davies, Journ. Min. Agric. 32, 1926.)

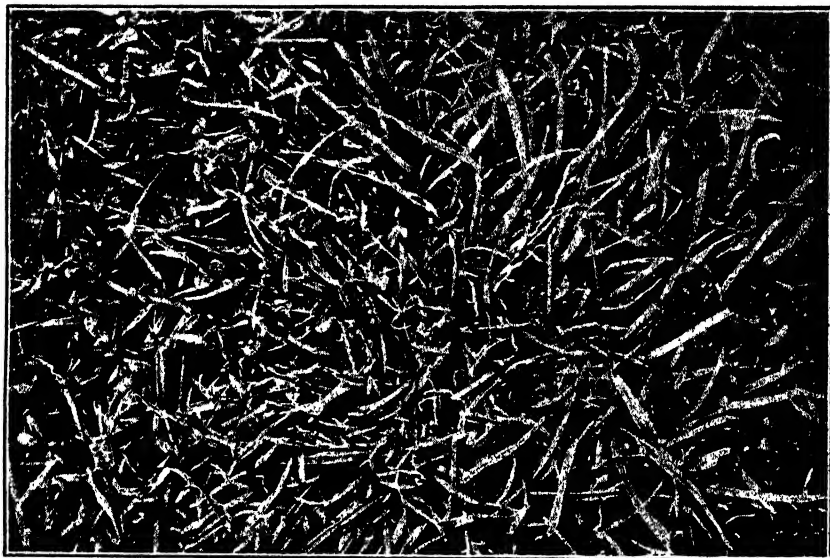


FIG. 7. COCKSFOOT FROM ABERYSTWYTH (Bc. 1629) EX LEICESTER OLD PASTURE, GROWING ALONGSIDE DANISH AND AKAROA (FIGS. 5 AND 6).

Type selected for fineness of leaf, multitillering, low-set crown, and persistency.

[Photo by W. Davies.]

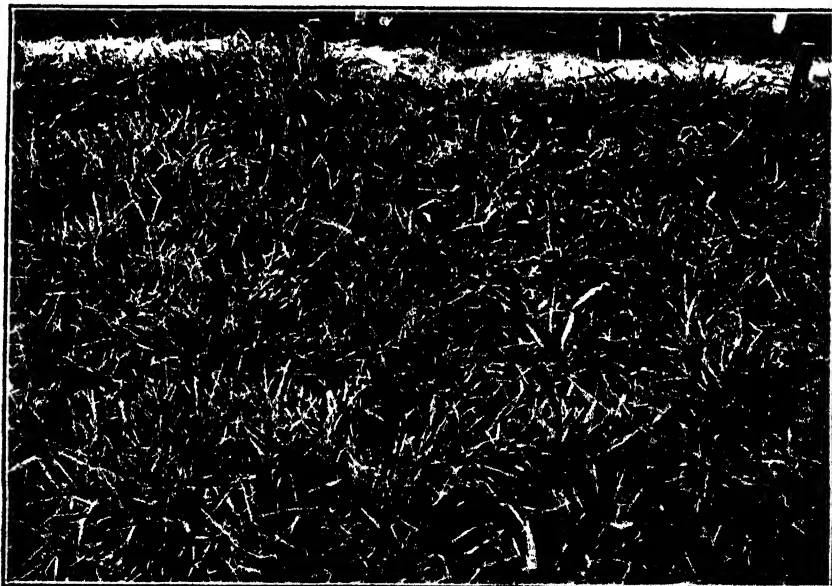


FIG. 8. AKAROA (LEFT) AND DANISH COCKSFOOT (RIGHT) COMPARED FOR WINTER GROWTH.

The Akaroa cocksfoot grew moderately well all winter, but Danish was winter-dormant from April to August. Compare Figs. 9 and 10.

[Photo by E. Bruce Levy.]

but the plots are already showing differences in reaction. The short-lived Danish types are less productive under this treatment, while the multitillered Akaroa type is apparently thickening up and is producing a more or less dense sward of cocksfoot associated with an abundance of volunteer white clover. It will be some time before statistical results can be obtained to show the differences in holding-power between cocksfoot from various New Zealand sources. At present there is little apparent difference in type as between Akaroa, Plains, Wairarapa, Hawke's Bay, or Southland cocksfoot. All are outstandingly better than Danish cocksfoot. New Zealand cocksfoot, however, often contains a fair proportion of rye-grass as an impurity, and from our trials this seems to be specially true of certain lines from the Canterbury Plains, and occasionally also lines from other sources. N. R. Foy in a recent report (this *Journal* for May, 1929) has made further reference to the incidence of rye-grass in samples of New Zealand cocksfoot tested at the official seed-testing station.

Having regard to the fact that trials both in New Zealand and in Great Britain have conclusively shown that this country already produces in commercial quantities a good pasture-type of cocksfoot, it is of great importance that the type shall not be lost until such time as approved strains of a still superior type become available in quantity. There is a need for co-operation between growers, merchants, and consumers to ensure and to increase supplies of approved cocksfoot types at least up to the point at which the whole of the New Zealand requirements would be filled. Further than this, there are immense possibilities for building up an extensive export trade, a subject that will be dealt with more fully in a subsequent article of this series. For long lea conditions and for permanent pasture we firmly believe, having due regard to the evidence before us, that not an ounce of the short-lived Danish cocksfoot should be sown either in Britain or in New Zealand. There is need for action to ensure that adequate supplies of cocksfoot-seed of the right type are forthcoming to fulfil the requirements of both countries.

New Zealand is annually importing a large quantity of cocksfoot-seed, nearly all of this being the short-lived, non-pasture type. In 1928 rather over 50,000 lb. of New Zealand cocksfoot was exported, this amount being negligible in comparison with the cocksfoot importations. New Zealand apparently uses about 3,000,000 lb. of cocksfoot-seed each year, and of this amount some 62 per cent. is home-grown and about 38 per cent. of the imported varieties. According to official statistics, for the seven years 1921-28 the average amount of cocksfoot-seed produced in New Zealand was about 1,885,000 lb annually, and for the four years 1925-28 inclusive about 1,130,000 lb. of cocksfoot was imported annually into New Zealand. For a country with almost unlimited scope for seed-production, and already producing a good type of pasture cocksfoot, the consumption of imported seed of the non-pasture type is altogether excessive. This country essentially requires persistent, leafy, and high-yielding strains designed to withstand heavy grazing of a perennial nature. Danish cocksfoot does not fulfil this purpose, and is therefore an undesirable form. Britain is similarly using Danish and other short-lived strains of cocksfoot, only an insignificant amount of the New Zealand type being

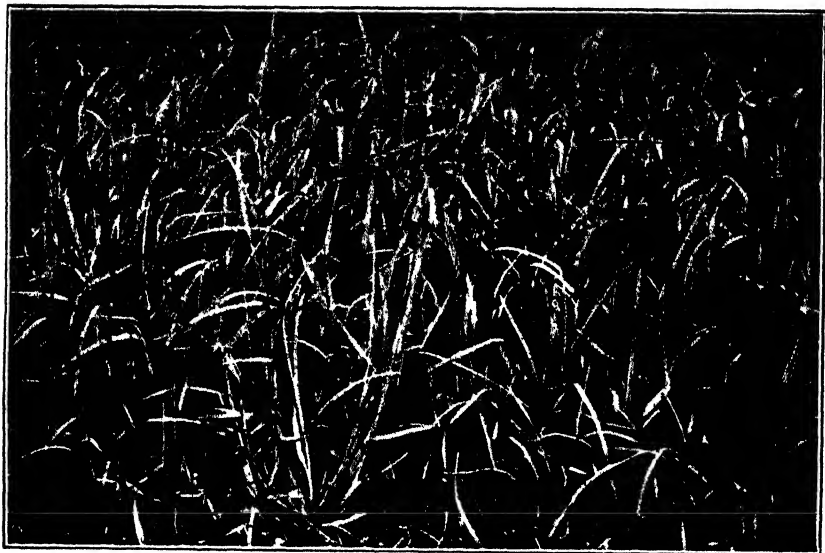


FIG. 9. DANISH COCKSFOOT AT END OF OCTOBER, SHOWING UPRIGHT STEMMY NATURE AND TENDENCY TO RUN TO SEED.

Compare Fig. 10.



FIG. 10. NEW ZEALAND COCKSFOOT TYPE AT END OF OCTOBER, SHOWING LEAFY AND MULTITILLERED CROWN, AND MUCH LESS TENDENCY TO RUN TO SEED THAN DANISH (FIG. 9).

[Photos by E. Bruce Levy.]

imported. A few of the leading English seed firms offer more or less good pasture strains, but these, in company with New Zealand cocksfoot, are retailed at a price considerably in excess of that ruling for Danish seed. The high relative cost of seed, coupled with a lack of real knowledge regarding the evaluation and significance of strain, tend to inhibit the wider use and extended sales of the pasture types.

If New Zealand is to compete successfully in world markets she will have to pay greater regard not only to strain or type but also to the improvement of seed-production methods. Cocksfoot-seed must be regarded as a definite crop and treated accordingly. Growers must know how to manure and how best to manage the cocksfoot-seed paddocks, having in mind increased yields of high-germinating seed produced at the lowest possible cost. Denmark has been growing cocksfoot for years, and has worked seed-production up to a fine art. Little regard, however, has been paid to the production of pasture strains. For the conditions of small holdings and of short rotations as commonly practised in Denmark the rapid-growing short-lived types may be excellent, but for countries where long-term rotations are practised this type is inferior.

New Zealand would do well to learn all she can of the seed-production methods of other countries, but while improvement in method is being effected the significance of strain must not be lost sight of. It is essential that the type be retained. There appears to be a world shortage of seed-supplies in regard to superior pasture strains of our commoner herbage plants, and we strongly submit that New Zealand should take steps to fill this need. There is no country in the world better suited or in a stronger position at the present time to bid for this market than is New Zealand.

BLENDING OF NEW ZEALAND BUTTER IN BRITAIN.

REPORTING on his recent official visit to Britain, Mr. W. M. Singleton, Director of the Dairy Division, remarks as follows on the above subject:—

Blended butter appears to be used by a considerable proportion of the consumers in the United Kingdom. So far as my experience went most of the blending appeared to be done in the London, Devonshire, and Bristol districts. It is known that some of New Zealand whey butter finds an outlet in blending with Argentine, Australian, Siberian, and Irish butters, and in some cases with New Zealand "Finest" grade creamery butter. I have been advised that in view of the fact that New Zealand finest creamery has to be purchased at a price which is above that of other butters used for blending, only sufficient of our best butters is used to give the necessary quality to the blended article. Estimates of the proportion of our total shipment which is used for blending run from 10 to 20 per cent. So far as I could learn the probability is that not more than 10 to 15 per cent. is used in this manner. While blenders are said to be keen to obtain whey butters for blending purposes it is also known that they are extremely anxious to get high-quality creamery butter from this Dominion for the purpose of introducing our creamery butter into the blended article. There appeared to be a good deal of information to the effect that the advertising of New Zealand and other creamery butters was causing the replacement of blended butters, and as a result blending was thought to be on the decrease. I was advised by retailers that the sale of butter in cartons was becoming more popular, and this is another factor which seems to be working in the direction of enabling unblended butters to replace the blended article.

DISEASES OF DAIRY COWS.

(Continued.)

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II. CONTAGIOUS BOVINE ABORTION—concluded.

(3) ELIMINATION MEASURES IN AN INFECTED HERD AND THE BUILDING-UP OF AN ABORTION-FREE HERD.

THE cleaning-up of a herd of dairy cows already affected with *Bacillus abortus* is in the first place a long affair, but it can be done successfully if the stringent precautions are carefully carried out by all associated with the management of the herd. The method of procedure is not the same in every case, and the details must be very carefully thought out, depending, of course, upon the importance of the herd—for example, its breeding-value; the economic value of the animals—that is, pedigreed, tuberculin-tested, or recorded; the facilities for handling the groups; and, finally, the extent of the infection. The procedure must of necessity be based on the result of the initial agglutination test, followed by segregation of reactors and non-reactors, or the isolation of the non-infected and the disposal of the infected. Vaccination of the latter, or even of the whole herd, may under certain circumstances be permitted. Every animal of breeding age in the herd must be tested, and only when the results are known can appropriate plans be formulated for the necessary control. This would naturally depend upon the number of reactors to the test.

The Agglutination or Blood Test.—The efficacy of the agglutination test in demonstrating the extent of the infection in a herd has been already discussed, but it is considered necessary that such test be repeated at suitable intervals in order to detect animals in the incubation stage or in a period of latent infection. Three tests are to be advised, carried out at four to six weeks' intervals, one preferably two or three weeks immediately following calving. This will eliminate all infected animals, but as in all biological tests doubtful cases must be met with, these can be grouped together as "suspects," and may be placed near the non-reactors till the next test. In the event of these suspects calving or aborting during this period, strict isolation, disinfection, and cleansing will be necessary. New purchases or young stock bred on the farm will be dealt with as in the case of the clean herd which was being protected from infection.

Procedure.—The method of elimination of contagious abortion was first formulated by Sir John M'Fadyean, who suggested and put into operation a scheme based on the establishment of herds free from infection on the results of the agglutination test. The question of what is to be done with the reactors is a matter to be decided on, and accordingly the percentage of same in the herd is usually the deciding factor. Segregation of the reactors and non-reactors will necessitate two units or groups, whereas disposal of the former or vaccination of the whole herd calls for no additional financial outlay or even change in routine. Where two groups are decided on the infected unit may or may not be vaccinated.

After the results of the general agglutination tests are known, the policy can be settled and the mode of action decided on. In long-standing infection the percentage of reactors is generally very high, and in consequence of the small number of healthy animals it is practically hopeless to consider dividing the herd and eliminating the reactors, owing to the heavy cost and large amount of labour and time involved. It would be advised in such a case that the best policy would be to vaccinate the whole herd with living cultures as discussed later. It is possible, however, to succeed in another way, and in fact in a relatively easy manner, by making the young stock bred on the farm the starting-point for the building-up of an abortion-free herd. This, of course, presupposes facilities for the maintenance of two units or groups.

On the contrary, when the infection is recent and the percentage of reactors is small, dividing the herd is advised, and the reactors are eliminated as soon as possible. It is worth remembering that such cows can be isolated on remote pastures as nurse-cows, and thus cause no additional trouble or real loss. Otherwise, sale for immediate slaughter or as additions to already infected herds are the only rational means of disposal.

When the infected are about equal to the non-infected, other things being considered—such as the economic value of the herd—dividing of the herd may be carried out. The non-infected group is removed as far as possible from the others, and isolated as the clean herd, and the infected is housed or depastured together as the infected herd, in separate paddocks, and buildings where such are provided, with its own utensils and, if possible, own attendants. Vaccination with living cultures of the whole of the infected group may with advantage be carried out. The milk is pasteurized before use, and the calves reared under suitable management to be added later to the clean herd.

It is only when the percentage of reactors is small—say, 20 per cent. at the most—and the owner can find it convenient to immediately dispose of these, that one set of paddocks, &c., will suffice for elimination.

The Clean or Non-infected Group.—Seeing that, as recommended above, all suspects are housed or depastured near the non-infected cows, they must be very carefully watched, and, in fact, inspected individually each day. This need not entail any additional labour, as their number will be small, but it will minimize the risk of an occasional abortion of an infectious nature. This examination should be made the rule in all herds where the risk of infection still remains in the vicinity, and especially so where two herds are being maintained on one farm as outlined above. Agglutination tests of individual animals must be carried out from two to three weeks after each calving, before newly calved cows are returned to the clean herd from the calving-paddocks. Should a calving or abortion take place in the common herd or at pasture the place and general surroundings must be very carefully disinfected. A special tested bull must be kept solely for use in the clean herd, and he must have passed the same three tests as the cows in the group. The elimination of infected animals from the herd necessitates further additions, either by the purchase of cows just at calving, or by bringing in the offspring from both groups, or even young stock reared in infected herds, but since

service kept isolated from the chance of infection. All such subjects must be submitted to the usual agglutination tests on admission.

In addition to the foregoing, the measures suggested for the protection of a herd found entirely free from contagious abortion at the first test must be carried into operation.

The Infected Herd or Group.—The infected herd comprises all the reactors to the agglutination tests, and the policy here adopted is to dispose of these as soon as possible, if few in number, even at a sacrifice; but, carefully managed, such a herd need not result in any considerable financial loss. The calves can be used for additions to the clean herd, for more than 90 per cent. of calves born of infected dams will react negatively to the blood test at from four to six months, depending, of course, upon the facilities for isolation immediately following the milk-drinking period. Calves recently segregated from the infected herd must be kept apart from heifers near the breeding-age, and at the same time must be removed from contact with the cows in the clean herd for an extended period following weaning from infected milk, in order to minimize the risk of carrying infection.

From what has been said it will be evident that heifers can be successfully reared from the infected herd, and accordingly used for adding to the clean herd or building up a new herd altogether. Provision will have to be made for a separate bull for the infected herd. Within the infected herd it is obvious that abortions will continue to occur until all the subjects therein have developed sufficient so-called immunity to enable them to carry their offspring to the normal time. In order to hasten such a desirable state the use of living cultures of *B. abortus* has been advocated.

The disposal of the animals in the infected herd should be a matter for the owner's most careful consideration, since sale without disclosure cannot be too strongly condemned, but even warrants State intervention, as already mentioned. The periodic removal of a few of these reactors for slaughter will suffice in the long-run to deplete the herd, and even dispose of it altogether. The real reason for this advice is perhaps not evident, but it must be obvious that breeding-deficiencies warrant such disposal—for example, calving abnormalities, metritis, retained membranes, and sterility even. In certain herds the chronic reactor remains a satisfactory milk-producer and breeder, but such herds are in the minority. Again, it has been suggested that reactors might with advantage be sold to neighbouring farmers whose herds consist largely of reactors to the blood test. Only those reactors which will conceive and breed normally can be disposed of in this way, for these animals are certainly worth more to place in an already badly infected herd than would be the non-reactors. The latter would immediately contract infection, with the usual disastrous results. The sanitary precautions necessary in order to prevent infection from being carried to other parts of the farm, and to safeguard neighbouring herds, consist of rigid disinfection at all times, and should include burning or burying in quicklime all aborted foetuses and foetal membranes.

The question of the sale of reactors must not be confused with the sale of cows which abort, for the sale of the latter can never be successful in eliminating the disease from the herd, since it can be appreciated that many other cows harbouring infection will calve to

time a viable calf, and yet act as spreaders of the disease within the herd. At the same time, the cow which has aborted once may possibly calve normally at the next gestation, but not necessarily so.

Having thus outlined the means whereby a clean herd can be protected and an infected herd cleaned up, it is obvious that the maintenance of an abortion-free herd is possible. Unless, however, the farmer is prepared and his workers are willing to carry out all instructions necessary, and to continue to do so, veterinary intervention is not only useless but a waste of both time and money. Towards this end, however, a demand must arise or be created for milk from abortion-free cows, either through State action or by the dairy-factories, or even by the public; and at the same time the farmer must learn to realize the losses consequent upon repeated abortions in his herd. With regard to the latter, in addition to the loss of the calf, there is the loss in production during the lactation period which immediately follows. This has been estimated at one-third of the normal yield, and therefore in the third year of a serious outbreak, when the abortions amount to possibly 50 per cent. of the herd, the loss to the farmer would be one-sixth of his total income for the year. In addition, also, there is to be reckoned the other consequences—namely, metritis, arthritis, sterility, &c.—and finally the upsetting of the breeding calendar, where seasonal yields are so necessary.

Treatment of Contagious Bovine Abortion.

The insidious nature of the infection and the chronic manifestation of the disease naturally permit one to assume that treatment would of necessity be difficult, and this has proved to be the case. It has been suggested that mineral deficiencies are responsible for the lowering of the natural resistance, and the theory of lack of calcium, iodine, &c., in the metabolic processes has its adherents; accordingly treatment embodying the use of such minerals in different forms has been tried both in prophylaxis and cure. Against this may be mentioned also the increase in virulence of different strains of *B. abortus* as perhaps an important factor in the infectivity of the organism. The true explanation of the spread of the disease is difficult to ascertain with certainty, but it can be definitely stated that no line of medicinal treatment yet tried has given any hope of success in combating the infection in the herd.

The infection in the case of many individuals is frequently followed by complete recovery when the organism is eliminated from the body, and the animal is assumed to have acquired a certain degree of immunity. Again, some cows seem to exhibit a natural immunity, and this is particularly seen in heifers which as calves, or even as yearlings, have been exposed to infection and subsequently isolated before being brought in for service. This would appear to account for the lower incidence of abortions amongst first calvers in infected herds. It has been considered by the French workers Vallée and Rinjard, of the National Research Laboratory, Alfort, that if an immunity is acquired it is an active immunity—or perhaps better an infection immunity—which persists only so long as the organisms remain localized in the animal-body—for instance, in the udder, where it has been shown that no clinical manifestations can be observed yet *B. abortus* is being excreted in the milk. This is the interpretation of the immunity

acquired by the use of B.C.G. vaccine against tuberculosis. The above-mentioned workers prefer, therefore, to assume that a great many of the animals in the herd acquire a "tolerance" to the infection, with the result that in subsequent pregnancies they carry the calf to the normal time, but still act as spreaders of infection, and at the same time become chronic reactors.

This interpretation of the so-called immunity would appear to offer a suitable means whereby a herd could be protected from infection, when suitable immunization methods would prove of service in preventing abortions, thus saving the calves by hastening the production of a herd immunity or "tolerance."

Sera, culture filtrates, and aggrassin have been tried extensively in America, but have so far failed to justify more than a continued study of such products. Bacterins or dead cultures of *B. abortus* killed by heat, formalin, or chloroform, have been employed in many countries, but so far they have proved of no value or only doubtful success in prevention or treatment. Living vaccines or cultures of unattenuated strains of *B. abortus* have been experimented with and even used extensively in the field in many European countries, and perhaps more so than available laboratory findings concerning their usefulness really warrant.

Treatment must therefore be on preventive lines, and when the disease has made its appearance the procedure to be adopted must be carefully outlined according to the extent of infection as assessed by the blood test, the individual herd requirements, and the facilities for handling which may be available.

CONSIDERATIONS ON VACCINATION.

In concluding this interpretation of the problem it may be of interest to deal with the use of living and dead vaccines or cultures of both virulent and non-virulent strains of *B. abortus*. In doing so the writer will outline the procedure being adopted in those countries visited by him. In most countries where protective inoculation has been made the subject of study the use of bacterins or dead cultures of unattenuated strains of *B. abortus* has been tried out alongside the employment of living vaccines or cultures, and in the hands of many world-famous workers very useful results would appear to have been obtained so far as the number of abortions is concerned. The following is a summary of the results recorded, giving the names of the workers and the country in which the work was carried out:—

			Vaccinated with Living Cultures.	Vaccinated with Dead Cultures.	Unvaccinated Controls.
<i>United States</i> :—					
Theobald Smith (Government)	..	..	57	..	163
Abortions	..	(per cent.)	14.0	..	28.8
Hadley (Wisconsin)	..	..	439	..	101
Abortions	..	(per cent.)	14.1	..	31.2
<i>Great Britain</i> :—					
Stockman (Government)	..	..	439	110	432
Abortions	..	(per cent.)	6.5	23.0	23.4
<i>Germany</i> :—					
Zwick, Zeller, Krage, and Gminder (Government)	..	..	440	886	1,356
Abortions	..	(per cent.)	6.36	13.2	18.06

		Vaccinated with Living Cultures	Vaccinated with Dead Cultures.	Unvaccinated Controls.
<i>Denmark</i> :—				
C. O. Jensen (Government)	.. ..	447	..	424
Abortions	.. (per cent)	23·7	..	36·8
Oluf Bang	.. ..	772	624	..
Abortions	.. (per cent)	16·3	39·7	..
<i>France</i> :—				
M. Rinjard (Government)	.. ..	188	..	60
Abortions	.. (per cent.)	9·57	..	28·33

These results would appear to be very encouraging, and no doubt the findings of the famous workers named were responsible for the policy now being pursued in the countries specified. Again, it would appear that the use of the dead vaccines or bacterins is hardly justifiable in view of these results, and accordingly its use has been discontinued in most countries.

It has been shown that the use of the living vaccine leads to infection, and that in certain animals it would certainly cause an abortion; but in others which have already aborted a tolerance to the disease is produced, with the result that the number of abortions in such animals will be reduced, but not necessarily the number of abortions in the herd when new and susceptible animals are being or have been introduced.

In interpreting the success or otherwise attending the use of vaccines, either dead or living, it is important to remember certain facts concerning the disease. Firstly, many abortions are not due to *B. abortus* infection; secondly, many animals in the herd have already acquired a tolerance to the infection, and therefore will not abort; thirdly, many animals in the herd may still be uninfected, and unless vaccinated may not abort, these, of course, usually including first calvers; and, finally, many cows will benefit by this artificially produced tolerance. In view of these facts, many of the figures recorded above may be unreliable and this would account for the lack of success in the application of living cultures of the unattenuated strains of *B. abortus* in practice.

Great Britain.—The use of the bacterin has been discontinued in Great Britain, but the living vaccine is still supplied by the Government to veterinary surgeons for use in the field. Records of results obtained by the use of such vaccine are not available, but, in the writer's experience, in the absence of proper hygienic measures in the herds vaccinated more harm than good has accrued from the indiscriminate use of living cultures of *B. abortus*. No organized attempt has been made in Britain to control or eradicate contagious abortion. The Epizootic Abortion Order has been in force for the past eight years.

Denmark.—The use of the live vaccine is permitted by the Government, but it is here prepared and issued by Professor Bang, of the Veterinary College, Copenhagen. Diagnosis is carried out in the Government laboratory free of charge, but the onus of reporting is placed on the farmer by a contagious-abortion order as in Britain. The effect of *B. abortus* infection on sterility has been carefully studied by Professor Folmer Nielsen, of Copenhagen, and he reports that there will be very little infertility, and that a mild type, in a herd free from contagious abortion. Again, "chronic" infection gives rise to very serious forms of sterility, and "acute" infection seems to have less tendency to aggravate sterility, probably because the abortions then

occur relatively early in pregnancy, so that involution is more satisfactory. In this connection it must be noted that Professor Neilsen is dealing with cases of sterility consequent on endometritis, retained membranes, &c., and not with "temporary sterility" as it is known in New Zealand.

Sweden.—The use of the live vaccine is prohibited in Sweden, and the bacterin is prepared and issued by the Government, which assists in diagnosis and control. The bacterin was used intravenously in the earlier days, but too many accidents attended its use, and accordingly a subcutaneous injection is now carried out at monthly intervals. No success can be claimed for the use of the dead vaccine.

Norway.—Living vaccines are used here in control of *B. abortus*⁴ infection, and a special order exactly on the same lines as in Denmark is in force.

Germany.—Both the bacterin and living vaccine are employed, and good success is claimed for their use; the latter, however, is preferred. The diagnosis and production of the vaccine are in the hands of the agricultural societies and veterinary colleges, which, of course, are subsidized for this work. Three years ago a central committee or commission was appointed to organize the control and eradication of breeding-diseases, and an attempt has been made to standardize the work and direct the policy of the State. Contagious abortion is tackled under three heads—(1) hygienic measures, (2) vaccination, (3) sterility treatment. The greatest importance is being given to preventive or hygienic measures, and unless the owner is prepared to carry out the work, and to continue to do so, vaccination is not undertaken. Since so many breeding anomalies arise from infection with *B. abortus*, it is considered essential that uterine irrigations should be carried out, and more especially so in cases of retention of the after-birth. Vaccination is usually carried out from four to six weeks after the act of abortion, two injections being given at an interval of fourteen days, and service is not permitted for at least another fortnight. One of the reasons why vaccination with living cultures is favoured in Germany is the fact that this method of intervention is considered to have a beneficial effect on subsequent sterility.

Holland.—A special commission has been appointed to consider the whole matter of contagious abortion, but at the time of the writer's visit this commission had not met. In Friesland the control and eradication of *B. abortus* infection is in the hands of the Hygienic Control Service. Living vaccine is favoured as in Britain, and good results are claimed for its use.

Belgium.—The State issues a living vaccine prepared as in Britain; one injection is given at least six weeks before service, and again the year following. Great success is claimed in badly infected herds.

France.—Under the direction of MM. Vallée and Rinjard, of the National Research Institute, Alfort, a definite plan of campaign is being followed. In many herds vaccination with the living vaccine is permitted, and where the herd has been divided the infected group only are vaccinated as already described. The scheme discussed at length by the writer would appear to cover most of the points outlined by these workers. It is of interest, however, to record the method of intervention practised when the whole herd is to be vaccinated with

living cultures. The herd is first divided into four groups after the initial agglutination test, and treated as follows:—

Non-pregnant Animals		Pregnant Animals.	
Infected. Group 1.	Non-infected. Group 2	Infected. Group 3	Non-infected. Group 4.
One injection of living culture	Two injections of living culture at fourteen-day intervals	Intervention useless	Intervention dangerous; isolate from Groups 1, 2, and 3
These animals must on no account be served till at least two months after the last injection		Await calving or abortion, and proceed as follows — One injection as in Group 1	Two injections as in Group 2

This immunization must be repeated for each animal after each calving or abortion. Satisfactory results have been reported as attending such methods of intervention.

In all countries the method of preparation of the vaccines varies in minor details only, and so also the procedure for immunization, but the principle involved is, comparatively speaking, the same. Only non-pregnant cows are vaccinated, although some additional success is claimed in Germany for two injections, one before service and the other early in pregnancy.

Reports from America regarding the use of vaccines prepared from an attenuated strain of *B. abortus* would seem to justify an intensive study of the matter. The strain used is said to be non-virulent for guinea-pigs by ingestion or subcutaneous injection, and appears to be able to protect a guinea-pig against a natural infection of *B. abortus* for at least six months. The use of the living cultures of this strain in pregnant and non-pregnant cows has not been attended with any untoward results, and it is also reported that the organisms are not to be found in the milk after vaccination of the subject. Experimental evidence would suggest that its use in bovines is justified, since a protection for eighteen to twenty-four months against mass infection has been shown to follow the use of such vaccines. If the successes reported for this method of vaccination with living cultures of a non-virulent strain of *B. abortus* can be repeated, great progress will have been made towards the control of contagious bovine abortion.

In conclusion, the writer would summarize the position which arises consequent upon the use of the living vaccines in a herd. It will be evident that the good which the vaccination does is more than counter-balanced by the harm which attends its use.

(1) All animals vaccinated react temporarily or permanently to the blood test, and thus eradication based on the test is impossible.

(2) The sale value of the herd is lowered, unless in a well-organized community where chronic reactors which will breed are an economic proposition for introduction into an already infected herd.

(3) There will always be an infected herd, and the abortions resulting from *B. abortus* cannot be eliminated, or even in many cases reduced within reasonable limits.

(4) Sterility and other breeding anomalies have resulted from the use of living vaccines, hence the breeding-efficiency of the herd is lowered.

(5) The elimination of *B. abortus* in the milk of vaccinated cows suggests the possible increase in the incidence of cases of undulant fever in man caused by *B. abortus*.

It will therefore be evident that vaccination can only be possible under conditions where the animals are sold for immediate slaughter and the milk is pasteurized before use, since ordinary methods of pasteurization suffice to destroy the organism. Such a herd may be retained for breeding purposes when the cows are isolated as nurse cows, and the calves are removed after weaning and isolated before removal for building up a clean herd or as additions to a non-infected herd.

(Series to be continued.)

CHEMICAL CONTROL OF RAGWORT.

EXPERIMENTAL WORK AT MAMAKU.

R. F. R. GRIMMETT and C. R. TAYLOR, Chemistry Section, Department of Agriculture.

FOLLOWING the preliminary observations recorded in the *Journal* for October last, arrangements were made for a comprehensive series of experiments in the chemical control of ragwort to be undertaken at Mamaku Demonstration Farm. These were designed to show the efficacy and cost of treating the plant with various mixtures of the ingredients—salt and sulphate of iron—previously used, under varying conditions of infestation, stage of growth, &c. By the time materials and labour were available the ragwort had already made vigorous growth, many plants being past the optimum stage for successful treatment. This and other circumstances prevented the full programme being carried out, but useful data were accumulated and are presented in the following matter.

Heavy rains experienced during the period in which the experiments were being carried out considerably modified the results that had been hoped for. A little rain following an application of the dry mixture of sulphate of iron and salt proved to be very beneficial, but the continual wet weather had a most adverse effect in that it almost completely washed the mixture from the crown of the ragwort plants. It is highly desirable that at least from three to seven days of fine warm weather should follow treatment: where such has been the case excellent results have been achieved.

Various methods and mixtures were tested over areas of different infestation, and to record observations in a simplified form the results have been tabulated. †

The most simple and accurate method of procedure was found to be that of cutting up the paddock to be treated in $\frac{1}{2}$ -chain strips marked off with a row of poles, and thoroughly doing that area before a further strip was attempted in the same manner until the whole paddock was completed. It was found that on areas of moderate infestation (say, three thousand plants per acre) two men could quickly and efficiently treat 2 acres per day between them. On other areas the time taken depended, of course, on the amount of weed present and its stage of growth.

Ragwort Control Experiments at Mamaku Demonstration Farm.

No.	Paddock Number and Area treated.	Infestation	Mixture per Acre.	Rate per Plant.	Approximate Number of Plants per Acre treated	Approximate Number of Plants per Square Yard.	Cost of Material at 8s per Hundred-weight.	Labour per Acre, in Hours.	Cost of Labour at 1s 9d. per Hour.	Total Cost per Acre.
							£ s d		£ s. d.	£ s. d.
1	Paddock 10A: 1 acre	Heavy	6 cwt salt and iron (50-50)	oz. $\frac{1}{2}$ -2	11,000	2 $\frac{1}{2}$	2 8 0	54	4 14 6	7 2 6
2	Paddock 7: 4 acres	Moderate	1 $\frac{1}{2}$ cwt. salt and iron (50-50)	1	3,000	$\frac{1}{2}$	0 12 0	13 $\frac{1}{2}$	1 3 7	1 15 7
3	Paddock 6: $\frac{1}{2}$ acre	Extra heavy	8 cwt. ($\frac{2}{3}$ salt $\frac{1}{3}$ iron)	$\frac{1}{2}$ -2	14,500	3	3 4 0	80	7 0 0	10 4 0
4	Paddock 6: $\frac{1}{2}$ acre	Extra heavy	7 cwt. iron alone	$\frac{1}{2}$ -2	12,500	2 $\frac{1}{2}$ -3	2 16 0	72	6 6 0	9 2 0
5	Paddock 6: $\frac{1}{2}$ acre	Heavy	6 cwt. ($\frac{2}{3}$ iron $\frac{1}{3}$ salt)	$\frac{1}{2}$ -2	11,000	2 $\frac{1}{2}$	2 8 0	56	4 18 0	7 6 0
6	Paddock 6: $\frac{1}{2}$ acre	Moderate to medium	4 cwt. salt alone	$\frac{1}{2}$ -2	7,000	1 $\frac{1}{2}$	1 12 0	36	3 3 0	4 15 0
7	Paddock 6: $\frac{1}{2}$ acre	Heavy	6 cwt ($\frac{2}{3}$ salt $\frac{1}{3}$ iron)	$\frac{1}{2}$ -2	11,000	2 $\frac{1}{2}$	2 8 0	56	4 18 0	7 6 0

REMARKS.

- No. 1: Uneconomic; good mixture. Ragwort completely died down, but owing to rain and great vitality of old plants, young growth reappearing.
- No. 2: Good mixture; sound procedure. This 4-acre paddock was completely cleaned up of all advanced growth in very short time. An excellent example of successful use of this treatment.
- No. 3: Excellent mixture, uneconomic. Paddock requires ploughing several times and resowing. Infestation heavy, and cost of labour makes eradication by this method prohibitive. Mixture acts quickly.
- No. 4: Poor mixture. Remarks on infestation as above. As iron takes considerable time to act, results not satisfactory. Uneconomic.
- No. 5: Infestation too heavy to treat economically. Ploughing seems to be only remedy. Very poor mixture, soon lost after heavy rain.
- No. 6: Doubtful results on account of slow-acting character of salt. In a few instances treatment appeared successful.
- No. 7: Best mixture; uneconomic. Trial followed by one day's fine weather only. All ragwort was completely exterminated within three days.

NOTE.—The term "uneconomic" as here used refers only to the use of the mixtures under the particular conditions of infestation, it does not refer to the mixtures.

The best and most economic period for treatment appeared to be when the plants were about 3 in. high. They could then be seen distinctly, and required considerably less of the mixture to completely destroy them than was the case when allowed to grow 6 in. to 9 in. high. If permitted to reach anything near maturity before this method of eradication is resorted to the great vitality of the plant makes it necessary for 2 oz. to 3 oz. of the mixture to be used instead of from $\frac{1}{2}$ oz. to 1 oz., and even then favourable weather conditions must prevail for at least one week afterwards.

Careful observation of the results produced by the various mixtures tested seemed to point to that made up of three parts salt and one part iron sulphate as the best. As a matter of fact, the results of this trial were outstanding, the plants being killed far more rapidly and surely with this mixture than with any other. There did not appear to be a great amount of difference in any of the mixtures that were composed of 50 per cent. of iron and over, but a decided difference was apparent when the salt was the dominant constituent. Here the plants were rotted to the roots very rapidly, and if there happened to be rain just following treatment the mixture was found to possess a more retentive character, and hence better results were a feature during both normal and adverse weather conditions.

Spraying was not at all successful, chiefly on account of the size of the plants, although the weather influenced the results quite appreciably. As was the case with the dry mixture, the solution containing the greater amount of salt was the most efficacious; but, interesting to relate, a salt solution alone gave but poor results and an iron solution but little better. These remarks are to be read as referring to the more mature stages of growth. Other small areas were sprayed with more success. Owing to the barrel sprayer not being available, only relatively small areas could be treated by hand-pump. However, several small patches of ragwort about 1 in. or 2 in. high were sprayed with a 10-per-cent. solution of salt and iron (50-50) mixture, and good results would doubtless have been obtained had it not been for the rain. The plants completely died down, but later young growth began to appear. There is sufficient evidence of good resulting from this method to justify a further trial being made at some future date.

In conclusion, from results already obtained, it is safe to assume that if the chemical dry-mixture method for the control of ragwort is commenced when the young plants are only 2 in. to 3 in. high, and under favourable climatic conditions, the cost per acre on farms of moderate infestation (three thousand plants per acre) will be negligible compared with the loss of stock that would probably result if the control of the weed were neglected.

The term "moderate infestation" is here applied to those areas where the weed can be, and is by some farmers, annually controlled by hoeing or grubbing (not mowing). An advantage the chemical method possesses over that of hoeing is that the weed is totally exterminated, and it is also much quicker than grubbing the plant out by the roots. Bruising the crown with the heel of the boot materially assists, with but little extra labour involved. In dealing with heavy infestations, the chemical method was clearly demonstrated to be uneconomic, the cost of labour being prohibitive, as shown in the tabulated results.

Further experiments at Mamaku, including spraying, are being planned for this summer, following mowing of the advanced growth.

THE SOILS OF TOKAANU.

A RECONNAISSANCE SURVEY.

R. E. R. GRIMMETT and F. J. A. BROGAN, Chemistry Section, Department of Agriculture.

IN continuation of the work initiated by Aston on the soils of the North Island volcanic province,* a reconnaissance survey was made by one of the writers (R. E. R. G.) during last winter on the soils in the vicinity of Tokaanu, at the southern end of Lake Taupo. Before discussing results acknowledgment is due to the Geological Survey, and especially to Mr. L. I. Grange, for permission to use and publish his geological map of the district, which was made a basis both for the field investigation and subsequent mapping. Acknowledgment is also due to the Department's Chief Chemist, Mr. B. C. Aston, for facilities and criticism, and to Mr. C. Taylor, who assisted with the field-work.

SOIL TYPES AND SERIES.

The soils of this area, which at present is largely idle land, show considerable diversity. They fall into probably three series, with suggested names as follows:—

(1) Taupo Series: Subærial Taupo pumice, comprising coarse sands, coarse sandy silts, sandy silts, and probably fine sandy silts, on the flatter higher ground and over the higher parts of the lower alluvial flats

(2) Tongariro Series: Water-sorted (alluvial) deposits of recent origin, bordering the Tongariro River and the lake-edge. These comprise coarse sands, fine gravelly sand, coarse sandy silts, fine sandy silts, sandy loams, silt-loams, and loams. They consist of mixed particles of andesite, greywacke, and rhyolite.

(3) Tokaanu Series: So far with only two types—sandy loam and loam, occurring on steep and broken andesite hills and consisting of andesite mixed with Taupo subærial pumice by slipping and soil-creep.

Taupo Series.

This is the dominant series in the district, but in the area mapped it is shown occupying the high ground to the north-west, east, and south-east of Tokaanu. Its characteristics are very similar to those of the Kaingaroa Plains pumice soil between Waiotapu and Wairakei, and, like it, the soil types are restricted to the sand-silt textures, coarse sandy silt, sandy silt, and perhaps fine sandy silt. An area of the latter type occurs on and about the Hautu Prison Farm, and at present it is uncertain where the boundary between alluvial and subærial soils occurs in this locality.

Chemically these soils are fairly rich in organic matter and lime (both available and total), and are moderately well supplied with

* See "A Reconnaissance Survey of Pumice Soils," in November, 1924, and subsequent issues of this *Journal*.

nitrogen, phosphoric acid, and potash when compared with other soils of subarial-pumice origin in the same province. Lime is in considerable excess of magnesia.

Above Waihi Native village a certain amount of dairying is being carried on on soils belonging to this series. A Maori-owned and operated dairy factory is located at Waihi, also a sawmill under the same ownership. At the Hautu Prison Farm sheep-farming is proving highly successful, particularly as regards fat lambs.

In places this series is underlain by a considerable depth of coarse loose pumice, and where the topographical relief is not marked one might expect the possibility of bush sickness occurring. That it has not done so may be perhaps attributed to the interesting fact that under such conditions the pumice soil in this area contains a large amount of black humus, which no doubt modifies its capacity for rendering available and retaining iron that would otherwise be leached out as soon as it became soluble. Fig. 1, showing a soil section at the Rangipo Prison Farm, illustrates this point.

Tongariro Series.

On account of their mixed geological origin (including a considerable amount of basic material), diversity of texture, and low relief the soils of this series will probably prove to be the most valuable in the district. In places along the banks of the Tongariro and Waiotaka Rivers some dairying and cultivation has been and is being carried on, mostly in a somewhat primitive manner, by the Native owners. A large part of the area is in swamp or inundated during the winter.

Bordering the lake is a broad strip of coarse sands which appear to be lake-washed and deposited as beach material. Behind this and bordering the rivers the soil-texture varies widely over short distances, making it impracticable in a reconnaissance survey to map accurately the boundaries of each type. Some quite heavy soils, loams, and silt-loams occur, and should be useful for certain crops.

With their diversity of texture and physical condition the soils of this series naturally vary considerably in chemical composition. Almost all, however, are rich in lime, which is not present as carbonate, thus resembling the Tarawera-Rotomahana series in Rotorua County. The amount of phosphorus, particularly in the available form, shows considerable variation; some soils are comparatively well supplied, while in others this element is somewhat deficient. Total potash is much higher than in the Taupo Series.

Tokaanu Series.

The boundary between the Taupo and the Tokaanu Series where the former overlies andesite depends mainly on the topography—steep slopes leading to admixture of material. For this reason it is somewhat irregular and indefinite, and where shown on the accompanying map must be regarded as tentative. The influence of the andesite is shown in the soil-texture, both types mapped being of a fine or loamy nature—"loam" and "sandy loam" respectively. From the few analyses made it would appear that lime is high in this series also. There is nothing

exceptional in the remaining figures, except perhaps the high lime-requirement and organic-matter content, which may not be constant features.

It would also appear that washings from the hills have spread over the adjacent alluvial flats, thus bringing them within the scope of the

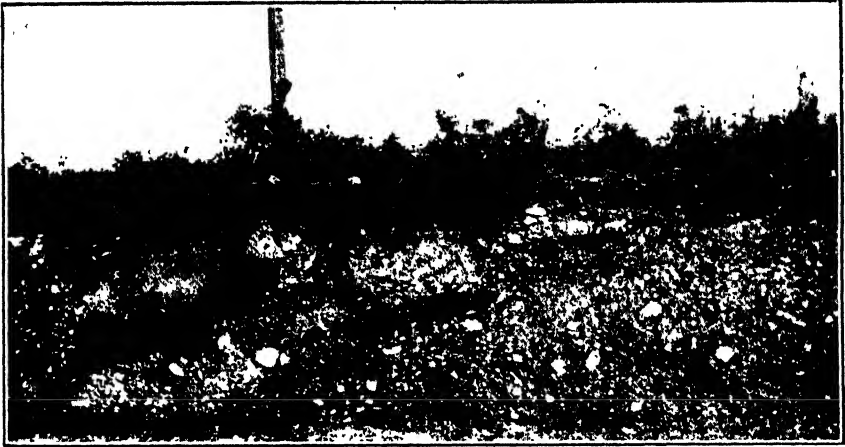


FIG. 1. SECTION OF HUMUS SOIL DEVELOPED ON COARSE PUMICE AT RANGIPO PRISON FARM.

On left is seen a very marked "pocket" of humus (black), probably washed into a cavity in the pumice.



FIG. 2. VIEW OF WAIHI NATIVE VILLAGE FROM ABOVE SCARP.

series. Many of the hill-slopes are probably too steep for successful cultivation, but profitable use might be made of the land in the immediate vicinity of Tokaanu Village.

An interesting case is that of the huge slip of 1846, which overwhelmed the Maori settlement in the vicinity of Waihi Village. The immediate cause was thermal activity along the fault-scarp known as the

Steaming Cliffs. As a result a large quantity of andesitic and thermally altered material has been brought to the surface, producing a bouldery but heavy loam soil.

VEGETATION.

The vegetation of the area is not only considerably varied, but has been altered by burning, mulling, and introduced plants.



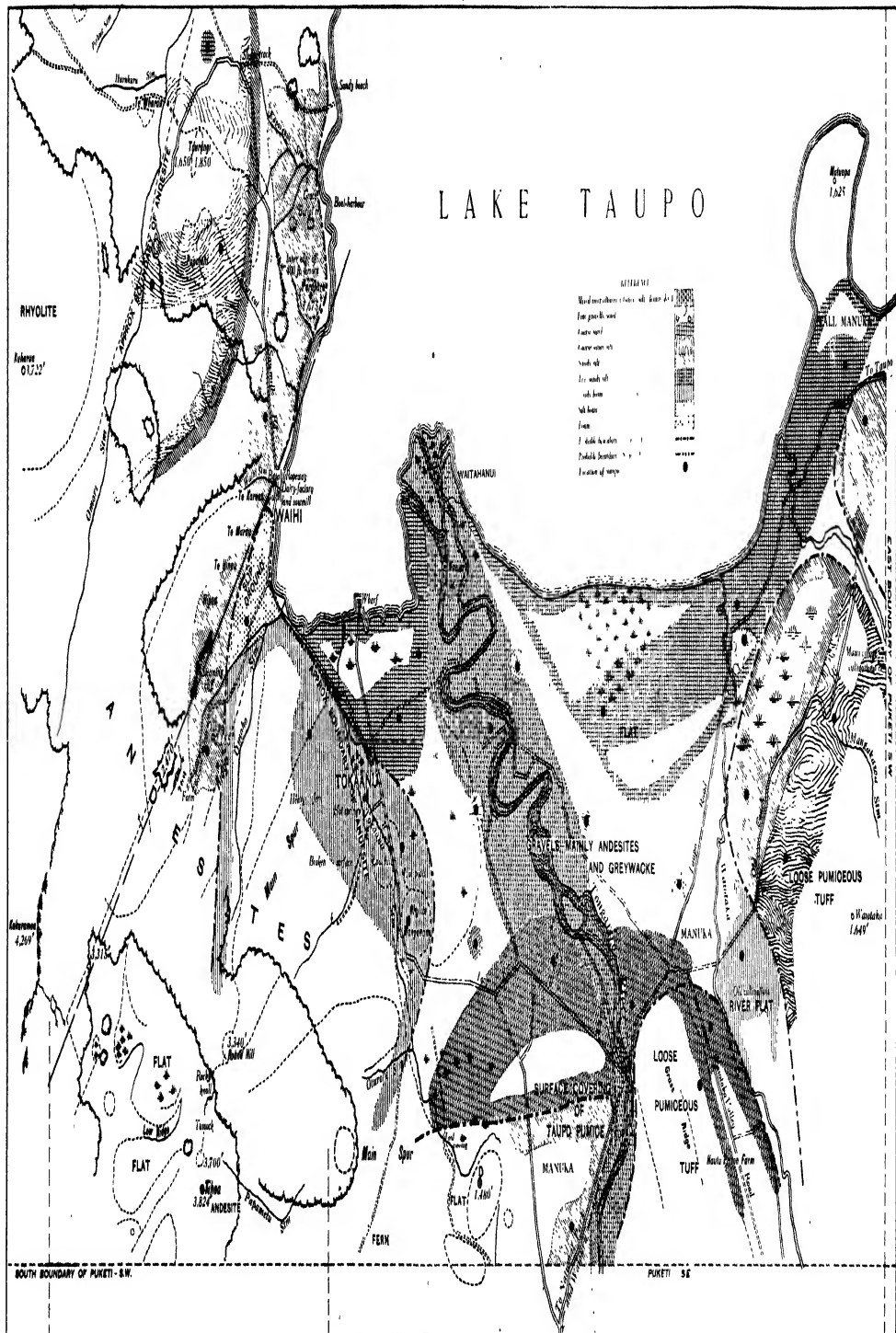
FIG. 3. VIEW OF TONGARIRO VALLEY, WITH MANGANAMU HILL AND TOKAANU ON RIGHT



FIG. 4. MAORI DAIRY-FARM ON HILLY LAND ABOVE WAIHI VILLAGE.

On the plateau above Waihi Village, on coarse sandy silt of the Taupo Series is a large area of heavy timber which is now being milled, though sufficient remains in its primitive state to give an indication of its character. Large trees consist principally of matai (*Podocarpus spicatus*) and totara (*P. totara*); rimu (*Dacrydium cupressinum*) is scarce. Other forest trees are *Knightia excelsa*, *Hedycarya arborea*, *Weinmannia racemosa*, *Melicytus ramiflorus*, and *Elæocarpus dentatus*. Shrubs and

TOPSOIL MAP, TOKAANU



Chemical Analyses of Tokaanu Soils.

Results, except *, are percentages on soil dried at 100° C

Laboratory No.	Locality.	Volatile Matter.		Total Nitrogen (in)	1 per Cent. Citric-acid Extract Dyer's Method, Hall's Modification ("Available Plant-food %").					Hydrochloric-acid Extract ("Total Plant-food %").				Lime re-quirement (per Cent. CaCO ₃).	
		* On Air-drying	* At 100° C		Magnesia (MgO)	Potash (K ₂ O)	Phosphoric Acid (P ₂ O ₅)	Lime (CaO)	Magnesia (MgO)	Potash (K ₂ O)	Phosphoric Acid (P ₂ O ₅)	(On Air-dried Soil.	(On Soil dried at 100° C.		
<i>Taupo Series.</i>															
Z															
776	Hautu Prison Farm—behind house	20.8	5.6	13.1	0.324	0.176	0.044	0.025	0.011	1.91	0.40	0.12	0.09	0.36	0.38
777	Hautu Prison Farm—behind house	20.0	3.1	12.4	0.328	0.177	0.041	0.019	0.020	1.04	0.31	0.10	0.10	0.33	0.34
778	Flats south-east of Lake Rotoaira	21.7	6.3	13.5	0.310	0.161	0.020	0.011	0.007	2.57	0.70	0.13	0.07	0.33	0.35
189	Rangipo Prison Farm	31.4	5.1	13.5	0.326	0.117	0.036	0.015	0.010	2.10	0.44	0.11	0.08	0.40	0.42
191	No. 2 paddock, Rangipo	34.5	1.6	14.1	0.100	0.173	0.041	0.021	0.009	1.75	0.40	0.10	0.08	0.46	0.48
219	Omaho 1—rhynolite hills east of Taupo Road	26.7	3.1	10.2	0.219	0.123	0.036	0.016	0.012	1.11	0.38	0.09	0.07	0.28	0.29
221	Puketū 11—flats	28.0	4.2	11.1	0.395	0.111	0.047	0.020	0.014	1.78	0.42	0.11	0.09	0.43	0.45
225	Puketū 9—Native dairy farm	24.5	5.6	13.1	0.321	0.119	0.035	0.014	0.008	2.20	0.48	0.11	0.07	0.45	0.48
230	Puketū 5—matai-totara forest	34.6	1.5	13.8	0.331	0.172	0.035	0.016	0.010	1.25	0.38	0.07	0.07	0.41	0.43
231	Puketū 5—above scarp on edge of Lake Taupo	27.1	6.2	14.0	0.319	0.168	0.036	0.015	0.004	1.67	0.41	0.10	0.08	0.35	0.37
233	Puketū 11—between Mangakoura and Waimarino Streams	3.9	10.0	2.10	0.116	0.035	0.022	0.007	0.007	1.44	0.50	0.28	0.06	0.30	0.31
237	Puketū 5—forest at end of tram-line road	4.3	11.5	0.331	0.221	0.016	0.021	0.007	0.007	1.48	0.36	0.08	0.07	0.31	0.35
<i>Tongariro Series</i>															
197	Puketū 10—edge of swamp east of Manganamu	34.4	12.5	11.4	0.336	0.075	0.018	0.069	0.004	2.21	0.78	0.29	0.07	0.38	0.43
207	Puketū 10—alluvial flats	27.5	5.7	11.3	0.285	0.151	0.050	0.015	0.005	2.62	0.91	0.32	0.11	0.20	0.21
199	Puketū 10—flats near Tongariro River	36.5	2.7	9.5	0.273	0.122	0.039	0.014	0.004	2.41	0.62	0.18	0.05	0.23	0.23
211	Puketū 11—large paddock	21.7	1.9	7.2	0.188	0.116	0.029	0.019	0.008	2.75	0.61	0.20	0.08	0.25	0.25
203	Puketū 10—flats beside Tongariro River	15.2	3.8	5.0	0.130	0.085	0.018	0.022	0.003	3.09	0.66	0.17	0.05	0.13	0.14
205	Puketū 11—flats beside Tongariro River	16.7	5.9	8.6	0.204	0.109	0.040	0.016	0.005	2.62	0.50	0.15	0.07	0.20	0.24
249	Puketū 10—alluvial flats south-east of Manganamu	29.2	7.5	12.9	0.312	0.109	0.024	0.015	0.005	2.46	0.76	0.29	0.09	0.35	0.38
209	Puketū 11—swampy flats between Hautu and Lake Taupo	37.8	4.4	12.9	0.391	0.113	0.027	0.013	0.007	2.53	0.45	0.12	0.08	0.32	0.33
217	Puketū 11—swampy flats	25.6	2.9	8.1	0.243	0.162	0.031	0.012	0.013	1.26	0.52	0.37	0.09	0.23	0.24
221	Omaho 1—west of Taupo Road	26.5	2.0	9.7	0.133	0.062	0.011	0.008	0.013	0.93	0.44	0.34	0.06	0.10	0.16
213	Puketū 11—flats between Hautu and Lake Taupo	44.7	8.0	15.1	0.101	0.172	0.032	0.017	0.011	1.32	0.74	0.45	0.14	0.37	0.40
229	Puketū 11—flats along Waitotaka Stream	35.1	4.6	11.1	0.293	0.157	0.030	0.011	0.014	1.00	0.62	0.11	0.11	0.32	0.34
251	Puketū 10—flats near Tongariro River	31.2	6.5	11.0	0.266	0.078	0.010	0.010	0.003	1.47	0.36	0.09	0.05	0.33	0.35
<i>Tokaanu Series.</i>															
195	Puketū 10—edge of raupo swamp near Tokaanu	6.3	5.3	0.773	0.180	0.015	0.014	0.010	0.010	2.21	0.12	0.16	0.12	0.47	0.50
241	Puketū 10—hills above road between Waihi and Tokaanu	20.5	8.7	10.1	0.322	0.152	0.031	0.029	0.007	1.72	0.12	0.13	0.06	0.57	0.62

Analysed by F. J. A. Brogan and E. B. Davies.

Mechanical Analyses of Tokaanu Soils.

Results are percentages on air-dried soil.

Laboratory No.	Description of Soil. (Classified according to States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm Sieve.					Loss on Ignition.	Soluble Matter.	Locality.		
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.				Clay	Moisture
<i>Taukapu Series.</i>											
176	Sandy silt ..	3.7	28.0	27.3	13.7	6.2	2.8	5.6	12.4	11.9	Hautu Prison Farm—hills behind house.
178	Sandy silt ..	1.6	17.0	28.5	25.3	9.2	4.0	3.1	16.0	18.4	Hautu Prison Farm—front flat paddock.
189	Sandy silt ..	2.0	36.7	30.3	14.0	5.2	3.1	4.2	11.9	8.7	Flats south-east of Lake Rotoaira
191	Sandy silt ..	2.0	38.2	27.3	14.0	5.2	3.1	4.6	12.8	11.8	Kangapo Prison Farm—between road and plantation.
193	Coarse* sandy silt ..	8.3	31.1	47.0	10.3	5.2	3.5	3.6	13.7	6.9	Omata 1—hills.
200	Coarse* sandy silt ..	5.3	27.1	23.2	16.7	6.0	3.3	3.4	9.9	13.3	Puketii 11—between Mangakoura and Waimarino Streams.
223	Coarse* sandy silt ..	5.3	35.9	26.7	9.5	6.3	3.2	2.9	7.6	16.7	Puketii 11—flats
227	Coarse* sandy silt ..	1.4	22.0	28.3	14.2	7.5	7.8	4.8	12.3	10.0	Puketii 11—hills-slopes
231	Sandy silt ..	4.0	25.8	20.2	14.5	7.5	4.0	6.2	13.2	9.4	Puketii 5—above scarp.
233	Coarse sand ..	11.0	35.4	20.7	9.3	3.5	2.7	2.9	9.1	14.3	Puketii 5—undulating fern-country
235	Coarse sandy silt ..	4.3	27.5	28.1	12.5	4.5	2.2	4.4	16.1	15.4	Puketii 5—hills
237	Sandy silt ..	2.5	21.2	24.7	20.5	7.8	2.7	4.5	13.2	17.6	Puketii 5—mulled forest.
239	Sandy silt ..	2.3	27.4	23.2	11.2	6.3	2.2	5.6	12.4	5.7	Puketii 9—easy slopes on opposite side of valley to Steaming Chiffs
<i>Tongararo Series.</i>											
243	Sandy silt ..	0.3	27.6	26.6	10.5	7.8	4.2	7.3	12.1	6.1	Puketii 10—swampy flats, Tokaanu
249	Fine sandy silt ..	0.1	35.1	28.1	18.0	12.2	4.2	7.5	11.9	4.2	Puketii 10—alluvial flats
197	Silt loam ..	0.1	4.8	24.7	23.4	16.8	5.7	12.5	10.0	4.4	Puketii 10—edge of swamp to east of Manganamu.
203	Fine sandy silt ..	2.2	33.6	25.3	10.3	11.0	2.2	2.7	9.2	5.3	Puketii 10—flats near Tongararo River
205	Fine sandy silt ..	2.7	23.0	46.5	10.7	4.5	2.5	3.8	4.7	3.2	Puketii 10—flats beside Tongararo River
207	Silt loam ..	0.0	0.2	20.0	9.6	3.0	3.0	3.7	8.2	10.0	Puketii 11—between Lake Taupo and Hautu Farm.
209	Coarse sand*	2.9	43.0	16.9	37.5	4.8	5.7	5.7	10.7	2.9	Puketii 10—alluvial flats near mouth of Tongararo River.
213	Coarse sandy silt ..	0.9	20.4	21.7	18.5	5.5	3.2	1.9	7.1	2.7	Puketii 11—swampy flats between Hautu and Lake Taupo.
215	Loam ..	0.9	10.4	21.7	18.5	16.3	8.7	8.0	13.9	12.8	Puketii 11—flats between Hautu and Lake.
217	Fine gravelly sand ..	25.2	54.7	7.3	4.5	0.3	1.2	2.3	4.5	1.6	Puketii 11—swampy flats.
221	Coarse sand ..	14.3	53.8	8.2	4.3	1.2	2.5	4.8	17.9	2.5	Puketii 11—edge of swampy flats west of Taupo Road.
223	Coarse sand ..	11.4	52.7	7.9	3.7	4.5	1.8	2.0	5.2	8.8	Omata 1—low swampy flats west of Taupo Road.
229	Sandy loam ..	3.0	24.8	26.7	12.0	12.2	5.5	4.6	10.6	5.4	Puketii 11—flats, Waitotaka Stream.
231	Coarse sandy silt ..	14.8	28.9	29.3	13.7	4.7	2.3	6.5	10.3	4.1	Puketii 10—flats, Tongararo River.
233	Sandy loam ..	11.8	23.6	18.8	8.0	12.2	6.3	3.3	11.3	10.6	Pokaanu 4—flats, Tauranga-Taupo River.
255	Coarse sand ..	11.8	31.2	16.9	5.0	2.0	2.0	7.4	15.0	15.0	Tokaanu 4—flats, Waitetoko.
<i>Tokaanu Series.</i>											
195	Sandy loam ..	0.2	22.0	27.9	9.7	5.0	5.5	5.3	19.1	31.1	Puketii 10—edge of raupo swamp near Tokaanu.
201	Sandy loam ..	1.1	14.3	24.5	13.0	14.5	10.5	8.6	11.6	22.2	Puketii 10—slopes of Manganamu Hill.
241	Sandy loam ..	1.0	23.1	24.4	12.2	8.3	14.7	14.7	14.7	13.9	Puketii 10—hills between Wahi and Tokaanu.
247	Loam ..	3.3	17.8	12.3	12.0	13.5	13.5	11.2	9.7	13.9	Puketii 9—boundary landside near Wahi Village.

* Nearest classification; between coarse sand and coarse sandy silt; nearer to coarse sand.

Analyses by F. A. Denz.

small trees comprise *Brachyglottis repanda*, *Drimys colorata*, *Nothopanax arboreum*, *Coprosma grandifolia* and other species, *Myrsine Urvillei*, *Pittosporum tenuifolium*, and *Aristotelia racemosa*. Lianes include *Rhipogonum scandens* and various climbing-ferns. Epiphytes present are *Astelia* sp., &c., and filmy ferns. Tree-ferns and others also occur. No tawa, southern-beech, or tanekaha were seen.

In another adjacent patch of forest that had been longer milled the following were also noticed: *Fuchsia excorticata*, *Solanum aviculare*, *Geniostoma ligustrifolium*, and *Schefflera digitata*.

There is also in the same locality a considerable area of open fern country, off part of which, at least, forest has once been burnt. In many places this is now almost pure bracken-fern, with scattered plants of manuka and tutu. In other places it gives way to heath-like vegetation, including *Pimelia laevigata* and *Leucopogon Fraseri*. Fern also covers much of the area included in the Taupo Series in the vicinity of Rangipo Prison Farm.

On the Tongariro Series the two dominant primitive associations are raupo swamp in the wettest parts near the lake-edge, and a kind of wet "herb meadow" inland around the swampy border of the raupo. In drier places there are also dense thickets of manuka and blackberry, but these are both probably of a secondary nature. The herb meadow is scattered over with clumps and single trees of manuka (*Leptospermum scoparium*). Various species of rushes, sedges, and *Juncus* comprise the larger vegetation, while between these the ground is carpeted with moss, *Plantago* sp. *Violas*, *Prunus*, *Gunnera prorepens*, *Ranunculus* sp., and other small herbs. In addition *Lotus major* and white clover occur wild.

Manganamu Hill (it is doubtful in which soil series it should be included, if in any) presents an interesting facies of vegetation, much of it perhaps being secondary. *Leptospermum ericoides* and *Nothopanax arboreum* (20 ft.) are dominant in many places. Other plants are *Pittosporum tenuifolium*, *Weinmannia racemosa*, *Coprosma lucida*, *Myrsine Urvillei*, *Brachyglottis repanda*, *Knightia excelsa*, *Coriaria ruscifolia*, *Veronica salicifolia*, *Gaultheria rupestris*, *Pomaderris phyllicifolia*, *Geniostoma ligustrifolium*, seedling rimu and southern-beech, ferns, &c.

CONCLUSION.

While it is not pretended that the map delineates the exact boundaries of the soil types and series, it serves to establish their existence, and to show that over limited areas considerable potentialities exist from a farming point of view. Certain peculiarities of the soils, such as their high lime content, are also worthy of note.

The results obtained by the prison authorities at the Hautu and Rangipo prison farms testify to the healthiness and productivity of some types at least of these soils. The genial climate and the manner in which sound farming methods have been applied must be given due credit in this connection. That lambs reared on Hautu should have obtained top price in the open market is a significant fact. There is perhaps no better index to the evaluation of soil than that supplied by the growth and health of the lamb.

FARMERS' FIELD COMPETITIONS.

TARANAKI, WANGANUI, AND FEILDING DISTRICTS, SEASON 1928-29.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

FARMERS' field competitions were conducted last season in the Provinces of Wellington and Taranaki on lines similar to those of preceding years. A very large increase in entries was again experienced, the figures for the past three years being 268, 370, and 503 respectively. The total entries received from the different districts were as follows: North Taranaki, 345; South Taranaki, 96; Wanganui, 20; Norsewood, 13; Feilding, 15; Wairarapa, 14. It will be seen that North Taranaki had the greatest number of entries, the reason for this probably being that in this district a strong competition executive representative of all farming bodies is established, and organizes and controls practically all competition work.

A pasture competition was commenced in North Taranaki last spring, and its value was at once recognized. It was fully reported on in the *Journal* for February, 1929. This competition is being greatly extended in the current season, as the farmers are fully alive to the benefits to be derived from it.

MANGELS.

Ninety-three crops of mangels were judged during the season under review, and the average yield per acre was 59 tons 14 cwt. The heaviest crop judged was that grown by J. N. Blyde, Lepperton, which weighed out at 114 tons 4 cwt., and won the Sutton Cup for North Taranaki. The variety was Prizewinner, and sowing was at the rate of 5 lb. per acre, with 6 cwt. of manure. In South Taranaki the Sutton Cup was again won by H. Betts, sen., Okaiawa, whose crop turned the scales at 108 tons 16 cwt. per acre. Mr. Betts, who is now in his ninety-third year, has been the successful competitor in South Taranaki for the last three seasons, with crops of 128 tons 19 cwt., 106 tons 2 cwt., and 108 tons 16 cwt. respectively. Mr. P. Turner, of Brunswick, grew the heaviest mangel crop in the Wanganui district with a crop of 94 tons 1 cwt.; Mr. J. R. Thompson was the winner in the Norsewood district with a 52 ton 4 cwt. crop; and Mr. A. Kidd secured first place in the Feilding district with a crop of 69 tons 19 cwt.

Worthy of record in connection with the growing of mangels is the crop which was grown by Mr. J. B. Hine, of Toko, for the fifth consecutive year in the same ground, and which weighed out at 63 tons 17 cwt. The five crops weighed 89 tons, 111 tons, 90 tons, 122 tons, and 63 tons respectively.

CARROTS.

Carrots generally were good, and the thirty-nine crops weighed averaged 41 tons 7 cwt. per acre. The heaviest crop weighed during the competitions was that grown by R. H. Jones, Tataraimaka, which weighed out at 67 tons 8 cwt. This crop, of the White Belgian variety, was grown in 7 in. drills, and the heavy yield was the outcome

of a great amount of hand work ; some of the carrots stood over 18 in. out of the ground. This crop won the Competitions Committee's cup. In South Taranaki J. J. Sulzberger, Mangatoki, won the championship with a crop of Matchless White weighing out at 64 tons 18 cwt., while G. Hells, Norsewood, grew the winning crop in this latter district.

SWEDES.

The growing of swedes still appears to be on the increase in certain districts, although dry-rot took a heavier toll of the crop during the 1928-29 season than has been the case for several years past. The average yield for 120 crops judged was 38 tons 14 cwt. per acre. The heaviest crop judged during the season under review was that grown by J. L. Corlett, Ratapiko, which turned the scales at 67 tons 3 cwt. and so won the Polson Cup. The variety was Knockdon, and sowing took place on 14th December, 1 lb. of seed per acre being used. In South Taranaki C. Cook, Lowgarth, grew the winning crop of 58 tons per acre, while in the Norsewood district E. Smith topped the list with a 26-ton crop. Booth Bros.' crop of 50 tons 12 cwt. secured premier honours in the Feilding district, while A. Tocker, Tauherenikau, with a crop of 42 tons 19 cwt., won in the Wairarapa.

SOFT TURNIPS.

The only competition for soft turnips was conducted in South Taranaki, where A. D. Johnson's crop, weighing out at 44 tons 12 cwt. per acre, topped the list. The average for the eight crops judged was 41 tons 5 cwt.

CHOU MOELLIER.

Eleven chou moellier crops judged averaged 31 tons 13 cwt. per acre, and the heaviest crop weighed was grown by J. L. Corlett, Ratapiko, which turned the scales at 48 tons 13 cwt. This crop was sown on 23rd December at the rate of 2 lb. per acre. Liberal use of farm-yard manure was no doubt responsible to a large extent for the heavy yield.

ENSILAGE.

Ensilage competitions were confined to Taranaki during the past season, and there were 130 entries. The making of ensilage is now a matter of annual practice on most dairy-farms in this province ; so much is this so, in fact, and so satisfactory are the results, that ensilage is slowly taking the place of roots and other supplementary fodder crops. In 1928-29 two definite classes were made for ensilage so far as the competitions were concerned, one being for pits and one for stacks. In the pit class are included all the hillside silos (or semi-pits), and as it is felt that this latter type can hardly compete favourably with the complete pit a separate class will cater for it in future.

The stack class was won in North Taranaki by C. B. Lepper, Lepperton, whose stack gained 93½ points (possible 100), and so won the Farmers' Fertilizer Co.'s Cup. The material was from pasture eighteen years old, which had been top-dressed previously with slag. Cutting commenced on 11th December just as the crop was breaking into flower. The stack measured 20 ft. square, and was built to the height of 7 ft. the first day ; forty-two hours were allowed to elapse, and then 9 ft. was added ; after a further eighteen hours another 11 ft.

was added ; and twenty-two hours later the stack was completed by the addition of a further 12 ft. A foot depth of soil was put on the next day, and held well out by poles. The topping was almost ideal and the waste greatly reduced, as evidenced by the points awarded—23 out of 25.

One of the greatest weaknesses brought out by the competition was the tendency on the part of many of the competitors to unduly delay cutting, with the result that much of the sap had gone out of the plant, and consequently the temperature rose too high. This results in a dark ensilage lower in value than the green. Cutting a week or a fortnight earlier would have been very advantageous in many cases.

The advantage of having the soil held well out to the edges of the stack was again demonstrated, and many and varied were the devices and methods adopted to bring about this desirable state of affairs. Worthy of special mention was the style used by Mr. F. T. Crowe, of Lepperton. Heavy wire netting was run round the top of the stack and held in place by wires threaded through the netting. Sods were then placed against the netting, and these in turn were backed up by the soil. It would have been an advantage, however, had it been possible to tighten the wires occasionally, and no doubt arrangements will be made for this on future occasions.

Mr. G. H. Bell, Oakura, again won the championship in the pit class, his entry scoring $95\frac{1}{2}$ out of a possible 100. The material again turned out in splendid condition, and the total waste from the whole pit could have been removed in a wheelbarrow. Mr. E. J. Locke, Hillsborough, scored second place with 95 points, and had the waste in this pit been less it must have won the competition.

The advantage of the concreted pit was again demonstrated, the small amount of waste and the facilities for handling being the strong features. It is fairly evident that to secure the best results a pit should be roofed ; and there is no doubt that much greater waste occurs where the pit is open to the elements. It is obvious that in a district where the rainfall is fairly heavy the rain falling directly into the pit must cause deterioration. Another interesting feature of the pit class was that all the pits which scored high points had perpendicular walls.

HAY.

The competition for haystacks proved very popular in Taranaki, there being seventy-two entries. Although the average for quality of hay was not high, this was more the fault of the weather than of the farmer. The building was again a credit to most of the competitors. Quite a number of stacks were again thatched, but the largest number were covered with iron.

The stack which won the List Cup in North Taranaki was that entered by H. Wallace, Lepperton, which scored 93 points out of 100, the loss of points being mainly due to quality deficiency. The best-built stack was that of G. H. Bell, Oakura, which was awarded $24\frac{1}{2}$ points out of 25.

GENERAL.

The organization of the competitions was on lines similar to those of previous seasons ; in North Taranaki a central executive controlled

the movement and awarded championship prizes in all sections, although the detailed organization was left to the various branches. Judging was again carried out by officers of the Fields Division, and

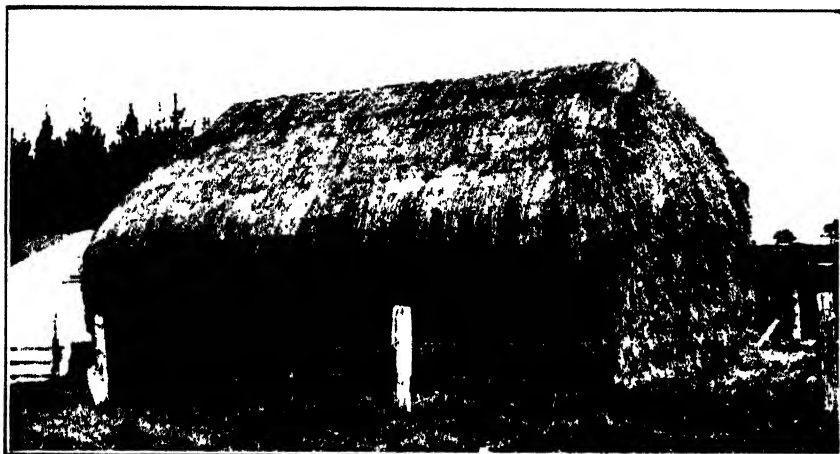


FIG. 1 HAYSTACK ENTERED BY MR G. H. BELL, OAKURA, WINNER OF THE BEST-BUILT CLASS.

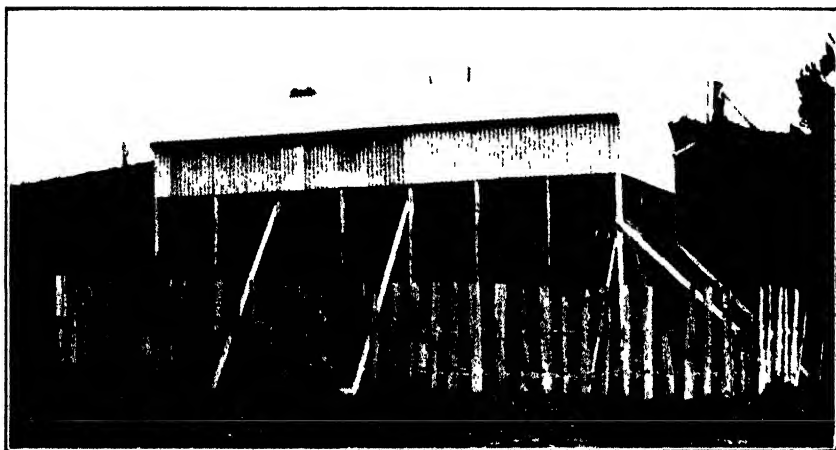


FIG. 2. A GOOD TYPE OF DUTCH BARN ON MR. BELL'S FARM.

Hay is put in from bank above, part of the iron roof being removed for that purpose.

as usual the Department of Agriculture awarded certificates of merit to all competitors who secured places in the various competitions.

Thanks are due to the donors of the various prizes and trophies, and to the various local organizations for their co-operation.

CONTROL OF CODLIN-MOTH IN ORCHARDS.

J. H. THORP, Orchard Instructor, Nelson.

A remit appeared on the agenda paper of the annual conference of the New Zealand Fruitgrowers' Federation this year to the effect that the control of codlin-moth should receive special attention by the Department of Agriculture. So much has been written during the last few years in connection with this pest, and so many investigations and experiments have been undertaken, that it is rather surprising to find the subject still a debatable one. That such was the position, however, was abundantly evident after hearing the discussion, the trend of the debate appearing to emphasize the fact that in some parts control was becoming more difficult, and that the pest was occasioning more loss to growers than had previously been the case.

To some orchardists present, and, I must confess, to myself also, the matter seemed unimportant, but since the conference I have studied the conditions in other fruit-growing countries, and find that the problem of codlin-moth control is also exercising the minds of some fruit-growers in the United States, and also in Australia, where the losses due to this pest are assuming far greater proportions than was previously the case.

Personally, I feel quite convinced that all that is needed to keep this pest under practically absolute control in this country is the use of arsenate of lead regularly and efficiently applied, plus careful and sustained orchard sanitation. The truth of this assertion can be substantiated by careful growers in any of the fruit districts; and it may well be asked, if some can attain such results, why not all? I believe the answer can be found in the fact that all growers do not regularly and efficiently apply the sprays, and do not give enough attention to the destruction of infected fruit, the neglect of which perpetuates and increases the infection from year to year.

There are sometimes circumstances under which spraying with arsenate of lead may not give absolute control, but I think it will be generally admitted that the specific is not to blame, and we must look to other causes, such as undue delay in commencing the applications, too long intervals between sprayings, unduly wet weather, and failure to renew the applications after rain. Under these circumstances, and in cases where infection may have been excessive the previous season, it is only fair to assume that the possibility of infection will be greater.

Here it may be well to consider what 10 per cent. of codlin-moth infection means. In a 10-acre orchard, with apples averaging 150 to the case, and 300 cases per acre, there would be 45,000 grubs, and if these were not collected and destroyed, it is easy to calculate the number of eggs which would be laid in the ensuing year, supposing half the moths were females and laid 80 eggs each.

Just how many grubs are carried over to the next season will depend entirely on the efforts made to destroy them. A proportion of the grubs leave the fruit while it still remains on the tree, others fall with the apples to the ground, deserting them when full grown, and in either case seek

refuge under the loose bark or in the cracks and crevices in the trees, or in other hiding-places nearby. Those infected apples that remained until picking-time are possibly thrown on the ground, or put into cases, taken into the packing-shed, and discarded at grading-time into old cases, perhaps left for some time before feeding to pigs or tipping out in some odd corner—just a thoughtless act in most cases, and done without weighing the consequences. Under ordinary circumstances the greatest amount of infection will usually be found adjacent to the packing-shed, because the old cases are usually stored there and the season's crop was assembled at that point. This fact alone demonstrates the necessity for taking precautions against future infection.

I commend the following procedure to those growers who may have had difficulty in obtaining satisfactory control of codlin-moth in the past. Thoroughly clean up and destroy all rubbish adjacent to the trees, such as old sacks, timber, &c. Remove branches which overhang old sheds and fences. Remove broken branches and cracked stubs from the trees, also scrape off and destroy the scaly bark, and place a bandage on the trees to trap the escaping grubs, and examine and destroy grubs regularly during the season. Where poles and props are used in the orchard, these also should be searched and cleansed.

When the petals have fallen, and before the calyxes close, spraying with arsenate of lead should commence, and should be continued at intervals of fourteen days up to the end of December, and thereafter every twenty-one days up to the end of February, using from $1\frac{1}{2}$ lb. to 2 lb. of arsenate-of-lead powder per 100 gallons of water, according to the weather conditions being experienced. The addition of $\frac{1}{2}$ lb. of spreader in the later sprays may be found desirable so as to ensure a better covering.

Judicious thinning of the crop will enable a better control to be obtained, but all infected fruit must be destroyed throughout the season, and all windfalls must be collected and dealt with in the same manner.

In the case of mixed orchards it may be difficult to fit in the constant spraying when stone-fruits have to be harvested, but no such considerations should deter an energetic grower from finding the necessary time to save his pip-fruit crop from infection.

I feel certain that in any district concentrated effort could practically eliminate codlin-moth altogether. This is instanced by what has been done in West Australia, which has over 11,000 acres of apples and pears. Between the years 1903 and 1928 there have been eleven outbreaks of codlin-moth in that State, and all have been stamped out. In 1925 the number of places found to be infected was eighty-one, grubs being found in thousands, and this outbreak was stamped out without destroying the sound fruit or the trees. To-day it is estimated that the absence of the moth saves the West Australian growers some £43,000 yearly. Such results as these should stimulate New Zealand fruitgrowers to adopt every known method to rid their orchards of this destructive pest without the necessity of compulsion.

WAIMATE WEST DEMONSTRATION FARM.

NOTES ON OPERATIONS FOR 1928-29.

J. W. DEEM, Chairman of the Farm Committee.

THE season of 1928-29 on the whole was quite a good one for milk-production at the Waimate West Demonstration Farm (South Taranaki), and the butterfat returns showed an increase of 734 lb. for the year ended 30th June last. This is satisfactory when it is considered that several old cows past their best were milked. Fresh cows could have been procured to build up the returns, but we were opposed to buying in fresh stock if it could be avoided owing to the danger of introducing disease. Fourteen yearling heifers bred on the farm are being carried this year, and will go into the herd next season to replace old cows.

The financial position of the farm continues to improve, the overdraft at the close of the year standing at £1,450, as compared with £1,939 in 1928, a reduction of £489. Sales of pigs amounted to £69, showing an increase of £17. Thirty "bobby" calves were sold and netted an average of 9s. 10d. per calf, against 5s. 2d. in the preceding year. The valuation of live-stock stands at £735 this year, compared with £721 in 1928. It is also interesting to note that the interest charges, for the past year were only £118, as against £155 for the preceding period. After allowing for the usual depreciation, the assets stand at £3,128.

PASTURES.

The farm pastures have to a great extent recovered from the grass-grub invasion mentioned in last year's report (*Journal*, November, 1929), but one or two fields were still badly affected during the past season. Probably now that the grub has gone over the whole of the farm it will be comparatively free from this pest for a time.

The tests between old-pasture perennial rye-grass and ordinary perennial rye in Field 4 are still very striking. The fundamental grass-land research areas in Fields 5 and 8, laid down by Mr. E. B. Levy, Agrostologist to the Department of Agriculture, present some striking comparisons, and are always worth a visit.

POTASH TOP-DRESSING EXPERIMENT.

This experiment was continued on the same lines as in the preceding year, 24 acres receiving phosphates and potash and 24 acres phosphates only, the grazing being done by the whole herd and factory weights of milk recorded each day. This year the area dressed with phosphates only showed an increase of 2,980 lb. milk, as against a comparative deficiency of 367 lb. for 1927-28, or a net gain of 2,613 lb. for the two seasons. The difference is really small and not very significant, and, when taken in conjunction with ocular observation, does not indicate any marked beneficial results from the use of potash on this farm. It should be mentioned that the fields dressed only with phosphates received extra super equivalent to the cost of the potash on the other fields, and at all times looked the best—if anything, being preferred by the cows—but there was not much difference.

NITROGEN TOP-DRESSING AND ROTATIONAL GRAZING.

Six acres were treated with sulphate of ammonia, in three dressings of 1 cwt. per acre. Very little result was noticeable during the period under review, but early this spring the nitrogen area showed a considerable building-up of the rye-grass content and a marked reduction in catscar.

An area of 24 acres has now been divided up into eight 3-acre paddocks, and water laid on. These fields have all had the same phosphate-manuring, but four have received an additional 2 cwt. of sulphate of ammonia per acre, the intention being to graze the whole eight fields on the most approved methods and record results to determine the value of nitrogen top-dressing on this land.

LUCERNE.

The lucerne stand continues to do well. The first cut, as usual, was made into silage, subsequent cuts being used for hay and green fodder. The practice of sowing 1 bushel of oats per acre on a portion of the area has been continued. This greatly increases the first cut for ensilage, and helps to control grass and weeds. Oats have now been used for six years, and so far have had no detrimental effect on the lucerne.

ROOT CROPS.

These were confined to 1 acre each of mangels and carrots, and about 1 acre of green maize. A poor strike was obtained with part of the mangels, and the area was redrilled with swedes, the combination giving a quantity of feed. Carrots and maize were good crops.

A number of varieties of mangels were grown on a special plot, and provided some splendid roots for the Hawera Winter Show. The four best varieties were Ferriston, 110 tons per acre; Red Intermediate, 108 tons; Prizewinner, 102 tons; Barres Stryno, 95 tons. Ferriston is a selection made by Mr. J. W. Hadfield, Agronomist, Department of Agriculture, and is a good cropper.

Hop-disease. Downy mildew of hop has been declared as a disease under the Orchard and Garden Diseases Act, and included in the First Schedule. Further, the introduction into New Zealand from any country of sets of any variety of hops has been prohibited as from 14th November.

Wool Research.—The Chairman's report at last month's meeting of the Council of Scientific and Industrial Research included the following reference to wool: "The investigations commenced at Massey and Lincoln Colleges are continuing. Arrangements have now been made which will enable Dr. Dry to give additional time to the study of the development of the fleece and its nutrition. Proposals have been submitted by the British Research Association for the Woollen and Worsted Industries, whereby the Dominion may participate in the results of their investigations. This matter will receive the consideration of the Wool Research Committee. A collection of representative fleeces, selected from flocks of known pedigree in both Islands, will be forwarded to Torrington for detailed investigation during the present shearing-season. In order to ascertain the precise uses to which New Zealand wool is being put, special inquiries are now being made in the United Kingdom. This is a most necessary step in order that the local wool-growers may be guided as to the particular nature of the wool required by overseas buyers."

INTENSIVE ROTATIONAL GRAZING OF PASTURES.

VARIOUS ASPECTS OF THE SYSTEM IN NEW ZEALAND.

A. W. HUDSON, Crop Experimentalist, Plant Research Station, Palmerston North.

INTENSIVE rotational grazing may be described as that system of grazing which enables the whole of the herbage on each of a series of fields to be consumed rapidly by stock while in a young, palatable, and highly nutritious stage, and then permits each field to be closed to stock and rested until the growth is sufficient to warrant the process being repeated. It aims at the provision of a sufficient number of fields to permit of the conversion of as much young grass into animal products for as great a portion of the year as possible, at the same time allowing for the conservation of sufficient hay and silage to provide supplementary feed for those periods when grass-growth is limited.

It may be reasonably contended that the majority of farmers have in the past practised rotational grazing to some extent. Practically every farmer has a number of fields which are grazed in some sort of rotation. The difference, however, between intensive rotational grazing and rotational grazing as ordinarily practised lies in the fact that in the latter case control and utilization of grass have rarely been complete, and have varied from good to very poor utilization. This is evidenced by the fact that it is comparatively rare to find a pasture which does not have a large number of patches of coarse grass that have run to seed after the month of November. The extent of these patches varies according to the degree of utilization during the spring months. Many farmers are inclined to regard this coarse material as evidence of good farming, and as an easy and convenient method of providing against shortage of feed during the late summer, autumn, and winter. Undoubtedly it is an easy method of providing coarse roughage for the low-production periods, and on certain classes of hill country where hay or silage cannot be made and roots cannot be grown there seems to be no alternative method if stock are to be maintained on the farm throughout the year. On land where it is possible to conserve surplus grass or grow supplementary feed, however, the practice must be strongly condemned as being an extremely wasteful method of providing feed for low-production periods. At the best, unconsumed roughage provides nothing more than a maintenance ration for stock, and as the season progresses it becomes more and more fibrous and indigestible. The fact that it is left by stock until they are compelled by hunger to consume it, while patches which have been kept short by stock are eaten as bare as the animals can graze, is a sufficiently good indication of its poor quality.

On the closely grazed patches the better and more palatable plants are continuously nibbled off, and never have a chance to bear much leaf, which is so essential to the plant-life, and they consequently die out. On the rough patches the coarse species exclude light from those species which need it most, such as ryegrass and white clover, and their growth is seriously retarded. The

advantage of the autumn rains, which always induce growth on efficiently controlled pasture, is largely lost where rough patches are abundant.

On the average farm it is not easy to avoid this undesirable condition entirely, but much can be done to improve the present methods—on a large number of farms at least—by adopting a better system of rotational grazing, accompanied by the conservation in the form of hay and silage of herbage which cannot be eaten by stock at the time it is produced.

Methods of Rotational Grazing.

(a) ON DAIRY FARMS.

Much valuable experience was gained last season in the management of paddocks under intensive rotational grazing from trials on some eighty farms, with two or more paddocks on each farm under treatment. In suggesting the adoption of this system it is not intended to advocate its immediate introduction to the whole of a farm. By starting with from two to six fields it is confidently expected that a farmer will be so convinced of its advantages that he will need no further persuasion in extending it to include, at least, a larger proportion of his farm.

Size of Fields.—Experience indicates that fields which will accommodate the whole of the milking-herd at the rate of from ten to eighteen cows per acre for short periods are easiest to manage from the point of view of grass-control. The average intensive rate of stocking under New Zealand conditions appears to be about fifteen cows per acre. (Number of cows in herd divided by 15 gives approximately the area for fields in acres). During the months October to December such fields will give from two to three days' grazing for the herd, according to the actual number of cows per acre, stage of growth when stocked, and fertility of the soil. From fourteen to twenty-four days will be required for the herbage to reach the grazing-stage again. Thus if each field provides two days' grazing, and the recovery period is twenty days, ten paddocks would be required to provide the necessary grazing during the period mentioned. The suggestion that a farmer might commence with from two to six fields implies that each field will be grazed only when the herbage has made sufficient growth after spellings of approximately fourteen to twenty-four days.

Reasons for Fields of Size suggested.—As stated, a field stocked at the rate of ten to eighteen cows per acre usually provides feed for two or three days. It is an interesting and noteworthy fact that when cows have been in a field for that length of time they generally show a desire for a change, even though there is still a fair amount of grass unconsumed. With fields of the size advocated most of the feed is consumed in the stated time, and the cows may be removed without much grass being left. With larger fields there is still the desire on the part of the animals for a change, and if not removed the milk-yield will decline. Obviously this is undesirable, so the cows have to be moved while a considerable amount of feed is still unconsumed. This unconsumed herbage, unless otherwise removed, is beyond the palatable stage when the cows

are again put in the paddocks, and is again neglected, those portions previously grazed and giving short, sweet growth being preferred. At each grazing the position becomes worse, until the paddock becomes a mosaic of closely grazed patches and patches of roughage.

Use of Dry Stock as Followers.—In Britain and Germany effective control of pasture has been rendered comparatively easy by the use of considerable numbers of dry stock, which follow the milking-herd after the latter have taken the best of the grazing. In the dairying districts of New Zealand it is very rare to find a sufficient number of dry stock on the farm to serve this purpose effectively. While full use should be made of available dry stock for cleaning up pasture, they cannot be relied upon to do this entirely, consequently it is necessary to make the utmost use of the dairy herd, and this can best be done by having small fields. Even then proper control is not always possible, and in the absence of dry stock the mower has to be introduced to remove the uneaten patches. Whether the mower should follow the dry stock, or whether the mowing should be done immediately after the milking-cows are removed, is a matter for investigation by each farmer. Grass cut and allowed to wilt for a few hours or a day is often eaten in preference to the same class of grass uncut; mowing before the dry stock are brought on to a field will probably result in their concentrating on the cut material, and thus the desired object will be achieved without waste where only a few dry stock are available.

The farmer's difficulty in finding time during the busy season to carry out such operations as mowing and harrowing is fully appreciated, but at least these can be done at some periods, and a proper overhaul of the mower during winter will be of material assistance.

Mowing and Harrowing.—If at no other time, mowing of uneaten herbage should be carried out during November before the usual spring rains cease. Control of herbage after this will not be so difficult, as fresh growing grass is becoming less plentiful and stock tend to graze more evenly. By the end of February it may and generally will be desirable to mow again to remove accumulated roughage and give the grass a chance to come away with the advent of autumn rains. As far as time permits each field should be harrowed with an implement which will spread droppings as soon as stock are removed. This applies particularly to the spring and early summer months, when rainfall is fairly regular. The spreading of droppings results in a good deal of fouling of pasture, but by the time the grass is again ready for feeding off the rain will have washed it clean. During the drier period usually experienced from January to March harrowing has to be suspended, because the rapid drying of manure renders spreading difficult and the fouled grass does not clean so readily. As soon as the autumn rains set in, however, no opportunity of thorough harrowing should be lost. Mowing and harrowing have been mentioned because both are essential to the proper carrying-out of intensive rotational grazing.

Lay-out of Fields.—Where the shape of the farm permits, the ideal lay-out is that of the central race with small fields on either side, each plentifully supplied with fresh water.

The "On-and-off" System.—Mr. R. Lindsay Robb, chief grassland adviser to Imperial Chemical Industries, Ltd. (London), has recently advocated the "on-and-off" system of rotational grazing. Briefly, it is as follows: When a field is ready to graze the cows are put in for one and a half to two hours after the morning milking, during which time they will eat their fill. Before they lie down to chew their cud they are returned to a field which has just been grazed, where cud-chewing takes place and most of the dung is deposited. About mid-day they are put in the new field again for a short time and removed after feeding. After the evening milking another grazing is given on the new field, and the cows are then returned to the grazed field for the night. As the best of the feed is consumed in each field the cows go on to another for short periods, being returned to what was previously their "on" paddock. The advantages of this system in lessening fouling of good grass and thus aiding in its complete utilization are obvious; the method is frequently adopted by farmers in the early spring months, when grass is in short supply and the fullest utilization by milking cows is highly important.

Advantages of Small Fields in overcoming Difficulties.—It will be noticed that the spring and early summer months only have been particularly mentioned in the foregoing remarks. These months are the only ones in which effective control of grass is difficult on most farms. As a rule sufficient stock are carried to ensure full utilization of all growing grass during the period from January to September inclusive. The difficult point to decide in the spring is how many fields can be properly grazed and still provide sufficient feed for stock, and how many fields are to be kept for silage or hay. Here again the advantages of the small fields are apparent. Consider, for example, a 50-acre farm in which the fields are each about 6 acres. Ordinarily 12 acres might provide sufficient hay and silage for supplementary feed. The closing of two fields (12 acres) may still leave an amount of grazing which it would be impossible to control with the stock available, but the closing of three fields (18 acres) may, on the other hand, result in an insufficiency of grazing and the conservation of an unnecessarily large amount of supplementary feed. To close an area intermediate in size between those stated would necessitate fencing and possibly watering at an inconvenient time for the labour available, and consequently would probably not be done. The result would be bad control of grass, or good control but with the punishment of stock. Fields of 3 acres on such a farm would obviate difficulties such as these and allow a greater flexibility of management, so far as area closed and time of closing are concerned. Further, it may be found that the spring promise of a good season is not fulfilled, and that fields which were intended for hay have to be brought into grazing after being closed for a few weeks. Again, the flexibility of management of small paddocks is apparent, for instead of having to break into a 6-acre field a smaller one may be used and may meet the temporary requirements. Hence the small field has the dual advantage of enabling proper control of pasture to be exercised and of providing greater ease of management of the farm.

(b) ON SHEEP FARMS.

In the case of sheep-farms situated on easy country there is no reason why intensive rotational grazing could not be carried out on

the same lines as with dairy farms. Fewer fields would be required for a complete cycle of grazing, or the grazing of each paddock would have to be confined to a shorter period. Utilization of herbage at a much shorter stage of growth with sheep than with cows is necessary, and during the height of the growing-season a field should be grazed at seven- to ten-day intervals. Lambing is usually over and lambs sufficiently old to allow of their being moved quietly before rapid growth of pasture begins. A few sheep-farmers are practising the system with great success, and experiments are being conducted to test its advantages. The sale of most of the lambs from the farm at about the stage when pasture-growth is falling off aids materially in management during periods of low production.

Effect of Intensive System on Pastures.

With good perennial strains of rye-grass, cocksfoot, and white clover intensive management is highly advantageous. The control of less desirable species such as Yorkshire fog and brown-top, and the frequent harrowing and spreading of droppings, provides conditions more favourable for the development of the better species, which, if well manured, improve considerably under the treatment.

Non-perennial species, which under good fertility conditions but bad management will reseed and re-establish themselves, can only have a temporary value in a pasture which is to be continuously submitted to intensive management. The very fact that the object of the system is to utilize grass in its young stage and prevent it from becoming rank and running to seed precludes the possibility of much reseeding, and a pasture containing a large amount of Italian rye-grass will deteriorate rapidly, even though this grass may have persisted for years under a system of improper control. Consequently it is highly important when the establishment of permanent pasture is contemplated that the seed mixture should contain a high percentage of true perennial rye-grass, and that where cocksfoot and white clover are sown persistent New Zealand strains should be used.

A pasture efficiently controlled during the spring and summer will respond rapidly to autumn rains and yield a larger amount of highly nutritious feed, uncontaminated with roughage, well into the early winter.

Nutritional Advantages of Young Grass.

Valuable work on pastures and pasture plants has been carried out at Cambridge (England), under Dr. Woodman, and at Aberystwyth (Wales), under Professor Stapledon, during the last few years, and some of the information resulting from the work is mentioned in what follows.

It has been shown that young grass is practically equivalent to or better than many concentrates in food value; the digestibility is higher than that of good linseed-cake, being approximately 84 per cent. as against 80 per cent. Young grass has the added advantage of supplying an abundance of vitamins and minerals such as lime and phosphate. A comparison between young grass and hay may be used to illustrate the advantages of the former, because badly controlled grass which has "got away" is practically equivalent to or even less valuable than hay, according to when it is utilized.

The digestibility of medium hay is about 52 per cent., whereas that of young grass is, as stated, about 84 per cent. The dry matter in young grass contains about four times as much digestible protein and over two and a half times as much digestible starch equivalent as the same amount of dry matter in hay. The fibre of young grass is practically as digestible and gives rise to as much sugar in the process of digestion as the starchy content of the grass, whereas the fibre of hay tends to be woody in character and of low digestibility.

In minerals, too, grass has a decided superiority over hay, the dry matter containing about twice as much lime and phosphate as does an equal amount of dry matter in hay. The work at Aberystwyth on the chemical analyses of the leaf and stem respectively of a large number of grasses emphasizes these points very strikingly. The leaf is higher in fats, protein, and minerals than the stem. The stem is higher in fibre and starchy material than the leaf. The great significance of these facts is apparent when intensive rotational grazing is considered. The system effectively carried out induces development and ensures utilization of leaf rather than stem, with the result that the material produced is consumed by the animal in its most nutritious and digestible stage. Grasses such as Yorkshire fog, brown-top, and danthonia, which become coarse and unpalatable if allowed to grow rank, become useful contributors to production when eaten young, and instead of causing rank patches in fields are almost as easily controlled as more valuable species such as rye-grass and cocksfoot.

Manuring for Intensive Grazing.

It would be difficult to decide which is the more important—manuring without intensive utilization of grass or intensive utilization without manuring. The former practice results in a waste, in that full benefit is not derived from the grass produced, while the latter is often difficult, because without manuring the quality and quantity of herbage is seriously lacking. In view of the recognized advantages of manuring, especially with phosphates, it would appear that manuring is the first essential, but the question which immediately arises is, "What is the use of manuring if full utilization is not going to be made of the extra grass produced?" The obvious conclusion is to combine both manuring and intensive utilization, and the farmer who has a definitely limited amount of money available for spending on improvement should see that after spending money on manures he has sufficient left to enable him to erect fencing, conserve feed not required immediately, and purchase stock, to enable him to derive the full benefit from the results of manuring. Lime and the various manures commonly used will be discussed under their respective headings.

LIME.

Where lime is deficient in the soil its use must be regarded as being equally essential to good production as a foundation is to a building. The heavier and wetter soil types are usually regarded as being most in need of lime. This may be so in a general way, but lighter and dryer soils are often as much in need of lime as any others. Every farmer should make it his business to find out whether his soil responds to lime or not. This is easily and cheaply done, the best plan being to dress

comparatively small areas in one or more fields at the rate of from 1 ton to $1\frac{1}{2}$ tons per acre. A strip of a few yards wide across a field will give more information than if the whole area is dressed, because comparisons are more surely made between parts of the same fields than between one field and another. The effect of lime *may* not be apparent for a year or more after application, so that it is very necessary to keep a close watch on its behaviour for two or three years and at all seasons of the year.

A comparatively heavy dressing, as indicated, should be used, because the effect of a heavy dressing is more easily observed than that of light applications. If a heavy dressing gives good results it does not follow that heavy applications must be made to ensure any improvement. The practice of applying a few hundredweight every year must be beneficial if lime is known to give results in heavy quantities, but the same marked response from a light dressing must not be expected as in the case of a heavy one. The effect of lime is usually manifested by an improvement in the quantity and vigour of clovers, and improvement of the better grasses, especially rye-grass, in vigour and density of sward. Stock will often show a marked preference for limed ground, and a more even and closer grazing indicates this preference. Where lime is beneficial the effect of a dressing of 1 ton per acre may reasonably be expected to last for a period of from four to six years, or even longer in some cases. Hence the cost of application may be comparatively small when viewed as an annual cost, and even a slight improvement results in a good financial return in yield, apart from the added benefit to stock.

PHOSPHATES.

Little need be said about the advantages of using some form of phosphate on the great majority of soils. The questions of kind of phosphate and time and quantity of application are, however, matters for consideration on every farm. For the purpose of this article the kinds may be divided roughly into two main groups: (1) Water-soluble phosphate, (2) phosphate insoluble in water.

Water-soluble Phosphate.—Apart from the newer fertilizers, such as Ammophos, Diammonphos, &c., the only commonly used phosphatic fertilizer which is soluble in water is superphosphate. Generally speaking, this phosphate is the most efficient form used. It is certainly the most rapid in effect, and although its effect may not be so prolonged as that of other forms of phosphate this need not occasion surprise. A fertilizer which gives up its material to the plant rapidly cannot be expected to last as long as one which yields its fertilizing-material slowly.

Phosphate insoluble in Water.—Slag, bones, and raw rock phosphates, such as those from Nauru and North Africa, come into this group. They vary considerably in their phosphate content, and a high percentage of phosphate combined with extreme fineness of grinding are the best indicators of value. Under wet and heavy soil-conditions they may be as beneficial as superphosphate, although not so rapid in action, but it is very rare indeed to find these forms of phosphate superior to superphosphate even when used at the same rate per acre. On the lighter soils of the North Island, such as the pumice soils of Auckland Province, there seems little doubt of the superiority of super over other forms. Statements have been made that the continuous use of super

will make the soil acid or increase its acidity, but this has been conclusively disproved. In this connection Sir John Russell, Director of the famous Rothamsted Experimental Station in England, may be quoted. After an address delivered at Palmerston North in 1928 he was asked if the continued use of superphosphate would make the soil sour. His reply was to the effect that superphosphate at the rate of 3 cwt. per acre had been applied to the same ground every year for the past eighty years at Rothamsted. Analyses of the soil had been made from time to time, and so far as could be determined there was no increase in the soil-acidity.

It is not intended to discourage the use of basic slag and other phosphates on soils where these give good results, because, although they may not be any better than super, farmers can rest assured that their use is not uneconomic.

Time of Application.—Recent work conducted by the writer at the Marton Experimental Area indicates that superphosphate has a marked effect on growth of pasture in from four to eight weeks after application, providing rainfall and temperature conditions are sufficient to promote growth. This brings up the very important point of time of application. Manure should be applied at such a time that its maximum effect is obtained during periods of low production. The aim should be the levelling-out of production throughout the year. There is no particular object in applying manure, so that its maximum effect is obtained during October, November, and December, when actual production is naturally at its maximum. (The exception to this is where manuring is done for the express purpose of increasing the yield of hay or silage.) Manuring, then, should aim at increasing growth from January to September inclusive. The greatest limiting factor to production during January, February, and March is moisture. The pasture plants which are responsible for the greatest production during this period, with the exception of well-managed *paspalum*, are the clovers. Hence the object should be to stimulate their growth as much as possible at this time, and there are definite indications from the work at Marton that this can be done to some extent by an early summer application of superphosphate. The dressing usually applied in August or September should be delayed until October, or even as late as November or early December, where the regular rains can be expected up to Christmas-time. The actual increase may not be large, but any increased growth during the late summer is highly important, and if absence of moisture limits production at that time the benefit from the dressing will be felt immediately after the autumn rains commence. For autumn and winter growth a dressing should be applied during March or April. The effect of this application will carry on into the spring, and assist growth in August or September. Whether more frequent applications are justified is a matter which is being investigated at the present time.

Quantity of Application.—This must be governed by the natural capacity of the land to produce and by the financial resources of the farmer. The minimum dressing on most soils should be about 2 cwt. per acre, but larger dressings are recommended. It is noteworthy that nearly all the observed farms of highest production are

using from 4 cwt. to 6 cwt. per acre per annum of some form of phosphate, usually in two applications.

POTASH.

With the exception of a few comparatively limited areas, potash does not appear to give very striking results in New Zealand. This may be due to the fact that it has been used in too small amounts in the past, and its application should be the subject for trial by farmers. In addition to the ordinary manuring practised, small areas should be tested as indicated for lime. For trial purposes from 1 to $1\frac{1}{2}$ cwt. of sulphate or muriate of potash should be used, or from 2 to $2\frac{1}{2}$ cwt. of 30-per-cent. potash salts. The application should be continued for two or three years on the same plot.

NITROGEN.

Nitrogen, chiefly in the form of sulphate of ammonia, is being experimented with very largely at the present time. There is no doubt regarding the effect of nitrogen in increasing the growth of grass, the only point to be decided is to what extent its use is profitable. Farmers are advised to test it as an adjunct to the ordinary lime and phosphate manuring usually practised. There are very good indications that its use for the production of early spring, late autumn, and early winter grass is likely to be profitable. On those fields where it was used last season there is a noticeable improvement in the density and vigour of the grasses, especially the better species—rye-grass and cocksfoot. While there is still some doubt regarding the profitable use of nitrogen in the late spring and summer, farmers should not use it during these periods until further information is available. To increase grass during autumn, and to prolong growth into the winter, an application of from 1 cwt. to 2 cwt. should be made in March or April, along with the phosphate dressing already recommended. For early spring feed similar application about the middle of July appears to be as good as any, although much investigation into the time of application is needed before a definite recommendation can be made.

The point which should be clearly understood is that grass-growth resulting from the use of nitrogen must be consumed while in a nutritious and palatable stage. The rapid growth, if allowed to get too coarse, results in waste and subsequent difficulty in control of the pasture. At the presents stage farmers are advised not to use nitrogen on poor pastures which do not contain a fair proportion of the better grasses. The more rye-grass present the more likely is nitrogen manuring to be profitable.

GENERAL.

The limited extent of this article does not permit of more complete discussion of the many problems of manuring, but sufficient has been said to indicate the important part it plays in the management of grassland on intensive lines. It is clearly obvious from investigational work in different parts of the world that our knowledge is still very incomplete, and that New Zealand has its own particular problems which can only be solved by carefully conducted experimental work.

BOYS AND GIRLS' AGRICULTURAL CLUBS.

THE MOVEMENT IN SOUTHLAND, SEASON 1928-29.

J. E. DAVIES, Assistant Instructor in Agriculture, Fields Division, Gore.

THE boys and girls' agricultural-club movement was actively launched in Southland at a meeting held at Invercargill in February, 1928, when Mr. R. McGillivray (then Instructor in Agriculture for the district) presided over a gathering of representatives of the Education Board, Agriculture Department, Agricultural and Pastoral Association, Southland League, Farmers' Union, Reginald Mackinnon Trust, and school-teachers. A committee was formed of delegates from these bodies. Subsequent meetings were held at Wyndham, Winton, and Gore, and further support enlisted at those centres.

For the first season's work the committee decided to confine activities to a potato-growing competition, and the following standard rules were adopted: (1) Entries to close on 8th September; (2) competitors to be under sixteen years of age; (3) size of plots to be $\frac{1}{4}$ acre; (4) plots to be on competitors' home farms or elsewhere; (5) records covering the crop to be kept; (6) the variety of potato to be Arran Chief.

As in other parts of the Dominion, seed, manures, and instruction forms were supplied to competitors by the Department of Agriculture. The Reginald Mackinnon Trust assisted by supplying a championship medal and cash prizes for the three placed competitors in each centre.

The response in entries was satisfactory, 167 competitors representing twenty-three schools taking up the work. For the purpose of localizing interest, more efficient control, and as far as possible classification of soils, the schools were divided into three centres—Wyndham (9), Gore (9), and Winton (5). In addition, each school was asked to appoint a field supervisor to render immediate practical advice and to assist the teacher.

Four tons of good certified Arran Chief seed potatoes were procured from the Templeton district, Canterbury, and each competitor received 50 lb. The Department's standard manure, of which 14 lb. was allotted to each competitor, consisted of three parts superphosphate, two parts blood-and-bone, and one part 30 per cent. potash salts, the rate of application being 5 cwt. per acre. Any other manure could be used in addition, provided it was shown on the chart. Instruction forms and record charts were also issued covering the whole competition. For a set standard of comparison the potatoes were grown in 26-in. drills.

The returns and the high general standard of work achieved can be gleaned by the following summary:—

Number of schools entered	23
Number of schools completed	23
Number of competitors entered	167
Number of competitors completed (at final judging)	147
Number of plots destroyed by stock	2
Number of competitors left district, illness, &c.	18
Heaviest-yielding crop (tons)	31½
Average weight of crops (tons)	16½
Average marks for cultivation (maximum 30)	25·2
Average marks for general appearance (maximum 10)	6·8
Average marks for quality (maximum 10)	7·2

Average marks for record chart (maximum 30)	..	..	..	13.5
Approximate total area of potatoes grown (acres)	..	..	..	4
Total yield (tons)	..	..	..	66
Yield of table and seed tubers (ton)	..	..	..	60
Approximate value of total produce grown by competitors	..	..	..	£450

It will be seen that selected seed with intense cultivation and careful attention on small areas were responsible for very fine average yields, thirty-nine competitors having grown crops of over 20 tons to the acre. An unsatisfactory point is the low average of 13.5 marks (out of 30) for record charts. This was due to the exceptionally high standard set by a few competitors.

Instruction and judging were done jointly by the writer and the Southland Education Board's Agricultural Instructor (Mr. T. Mathews). During the season two visits were made to each plot, and can be best described as junior field-days, teachers and supervisors accompanying the judges and competitors from plot to plot. The first visit was made during February, and the second in May, when a standard area representative of each plot was weighed, from which the competitors were instructed in computing the tonnage per acre.

The following allowance of points was adopted, and proved satisfactory: 1 point per ton per acre in weight, with a maximum of 30 points for cultivation, 10 for general appearance, 10 for quality, and 30 for record charts.

Competitors were circularized with notes on potato-disease and its prevention; yet the majority of crops inspected were unsprayed, and blight was much in evidence. On the other hand, competitors who carefully sprayed their crops were highly rewarded, one of them gaining the championship, and others ranking as winners of their centres. The champion crop, grown by Dudley Tayles, records careful spraying, and on examination proved free from blight; it also showed specially vigorous growth, with haulms standing over 6 ft. high.

In two cases shortage of seed was recorded, and these plots were completed with locally grown Arran Chief potatoes. This gave added interest, and weighings in both cases proved the superiority, by several tons per acre, of certified seed.

Allotments for the championship and various prizes were made as follows, the place named referring to school in each case:—

Championship Medal (highest aggregate points in the competition):—

Dudley Tayles, East Gore: Yield, 31½ tons; total points, 101½.

Special Prizes:—

Highest points in cultivation and general appearance (maximum 40):

Desmond Hillis, Kennington, 40.

Highest points in record chart (maximum 30): Greer Miller, Gore, 30.

Group Prizes:—

Wyndham district—

Herbert Dunth, Wyndham, 97½ points, first.

Desmond Hillis, Kennington, 96 points, second.

James Pow, Edendale, 92 points, third.

Gore district—

Dudley Tayles, East Gore, 101½ points, first.

Adrian Miller, Gore, 100½ points, second.

Ralph Smith, Gore, 95½ points, third.

Winton district—

Henry Middleton, Lora Gorge, 85½ points, first.

Lex Gerrard, Winton, 84 points, second.

Stewart Irwin, Winton, 83 points, third.

Presentation of the championship medal and prizes to winners in each centre took place at the annual meeting of the organization held at Invercargill. As recorded in last month's *Journal*, the Stuart Wilson Cup for the season was won by Dudley Tayles.

The Southland Agricultural and Pastoral Association offered a number of prizes to club competitors in the winter show at Invercargill for exhibits of twelve potatoes, record chart, and an essay ("My Plot"). In this connection no less than 120 competitors strove for honours. The show has a distinct educative value in potato-selection, and a social aspect in the reunion of members. The wearing of club colours did much towards the union of members.

In addition to the prizes mentioned, donations have been received from the Education Board, the Farmers' Union, and several special prizes from private persons.

LIMESTONE SAMPLES ANALYSED.

In his annual report for 1928-29 the Chief Chemist, Department of Agriculture (Mr. B. C. Aston), gives the following brief description of some of the more useful samples of limestone submitted for analysis during the year:—

X/1277 was a soft white carbonate of lime from Mount Gladstone, Marlborough; though containing only 58.5 per cent. carbonate of lime, its soft texture would render it a useful source of lime for local application. X/1278, from Kamo, Auckland, was a white semicrystalline stone containing 96.5 per cent. carbonate of lime; this would be a very suitable stone for production of quicklime. Y/150 was a soft, easily ground shell deposit from Napier district; it contained 93 per cent. carbonate of lime. Y/153, from Waipara, Canterbury, was from a deposit occurring in the form of a fairly fine powder containing 66 per cent. carbonate of lime. Y/158-160, from the Hastings district Hawke's Bay, were calcareous sinters ranging from 79 to 80.4 per cent. carbonate of lime. Y/215 was a useful coarse shelly grit from Onchunga, Auckland, containing 80.1 per cent. carbonate of lime. Y/216, a hard shell limestone (80.5 per cent. carbonate) was from Hedgehope, Southland. Y/263-68, a series of six hard, semicrystalline limestones from Te Akau, Ngaurawahia, ranged from 80 to 97 per cent. in content of carbonate of lime, the higher-grade material would produce an excellent quicklime. Y/270 was a specimen of calcite (pure crystalline carbonate of lime) from Kopua, Hawke's Bay. Y/303-10 were a series of hard, semicrystalline limestones of high grade, from Tinui, Wairarapa; their carbonate-of-lime content varied from 89 per cent. to 97 per cent. Y/572 was a moderately hard stone from the Cricklewood locality, Canterbury; it contained 94.5 per cent. carbonate of lime. Y/583, from Albury, North Canterbury, was a hard limestone of excellent quality, containing 96.25 per cent. carbonate. Y/631 was a friable calcareous sinter from the Greymouth district; it was stated that this substance, which contained 89 per cent. carbonate of lime, could be dug out with a shovel, and it would therefore require no treatment beyond air-drying to make it suitable for application to the land; unfortunately, such deposits as this are usually of very limited extent. Y/503, from Wairoa, Hawke's Bay, was a shell limestone of high grade (91 per cent. carbonate). Y/851, from a shell deposit at Onewhero, Auckland, contained 85.5 per cent. carbonate of lime. Y/837 was a friable sandy limestone from Albury, South Canterbury, containing 77 per cent. carbonate of lime. Y/1083, from Hawke's Bay, was a shelly conglomerate, containing 91 per cent. carbonate of lime. Y/1087 was a friable white carbonate of lime, 97.5 per cent. pure, from Ngapaenga, South Auckland. Y/1107, from Martinborough, Wairarapa, was also a friable calcareous deposit, containing 76 per cent. carbonate of lime. Y/839, a calcareous sinter from Wainui beach, near Gisborne, contained 94 per cent. carbonate of lime.

SEASONAL NOTES.

THE FARM.

Pasture Considerations.

It is now time for those who have in mind the sowing-down of pastures in the autumn to be giving thought and attention to the matter.

Of the several causes which may lead to the poor establishment of pastures one of the most markedly harmful is insufficient preparation of the seed-bed. The seeds that are used in pasture establishment are relatively small, and this means that a fine, firm seed-bed is essential if one is to avoid burying a number of the seeds so deeply that they have but poor chance of pushing their shoots to the surface. Certain of the valuable species often used in permanent-pasture seed-mixtures have seeds below the average in size, and the establishment of these species is apt to fail if a rough, poorly-prepared seed-bed is depended upon. Hurried preparation is a most fruitful cause of poor seed-beds; usually the work of preparation should be commenced at least a few weeks ahead of the date it is proposed to sow the seed. Only by doing this can the desired mellow consolidated seed-bed be obtained.

There are at times weak features in the seed-mixtures used, and as a means towards avoiding mistakes in this respect the advice of the Department of Agriculture may be obtained. The necessity for obtaining the best possible results in the laying-down of pastures is now generally greater than it ever was, for top-dressing and altered management tend to give pastures greater permanency, so that the influence of a weakness which creeps in at the time of establishment is likely to be felt not merely for a season or so, but for many years.

At times, if convenient, it may be advantageous to allow thin old pastures to run to seed if the growth contains a reasonable sprinkling of the more valuable species which can be looked to for an improvement of the sole. Subsequently, when the seed has ripened on such pastures, drastic tripod harrowing is desirable to cover the seed, but this should not be done until autumn rains sufficient to establish the seedlings safely may reasonably be expected. Under favourable circumstances this method will assist considerably in giving a better sole. It is most likely to be useful if for some reason ploughing is either not desirable or not possible.

Grassland from which hay or ensilage has been saved in good time may often be top-dressed advantageously with phosphates immediately after the removal of the mown material. Superphosphate usually proves excellent for this purpose. On account of the rapid manner in which it acts if there is sufficient soil-moisture present, it soon stimulates a fresh growth which is particularly valuable because it becomes available when fresh grass-growth is apt to be scanty.

It is highly desirable not to allow young pastures to produce seed in their first year, and this is especially the case if they are desired to be of a permanent nature. If the stock available prove insufficient to prevent seeding, topping with a mower as has been described in previous months' notes should be carried out.

Application of Phosphates to Grassland.

Evidence is accumulating which points to the value of the application of phosphatic manures to grassland much earlier than has been the common practice in the past. For instance, provided the customary rains of that season occur, application of phosphates to grass in February or thereabouts may be expected quickly to give increased growth which is of particular

value. If a prolonged dry spell should follow the application of phosphatic manure at that time no material increase in growth could be expected from it while the dry conditions continued, but the influence of the phosphate would not on that account be lost, and would be exerted as soon as autumn rains provided adequate moisture in the soil. When a farmer proposes to apply phosphates to any one of his paddocks only once in a year he could well make it his practice to top-dress at least some of them in the summer or autumn, leaving the others to receive attention in the winter. By so dividing the top-dressing programme he will not only secure, under average circumstances, extra grass-growth in autumn and winter, but will also spread the labour incidental to top-dressing and distribute better through the year the outlay which he makes in manure.

Forage-crop Requirements.

It often proves useful during January to make a survey of the prospects in regard to an adequate supply of forage for the winter and early spring. This is so because by January one usually has not only a knowledge of what the current summer has provided in the way of hay or ensilage or chaff reserves, but also an indication of what success for the season is likely to attend root and other forage crops. Should the amount of forage in view for the coming winter and early spring seem likely to prove insufficient for the stocking that is planned, there is still time, if other circumstances such as labour are favourable, to increase the provision.

In the first place, one may resort to an early autumn or late summer-sown temporary pasture. This consists essentially of Italian or Western Wolths rye-grass, 20 lb., and red clover, 4 lb. or 5 lb., to the acre. This must be sown early to provide any certainty that it will yield a substantial supply of winter feed, and it can generally be depended upon for a heavy hay crop in the next hay season. When the land available will be required for a spring sowing, Algerian oats or Black Skinless barley—both at the rate of about 2½ bushels of seed to the acre—may suitably be used on it for winter or spring fodder. In many cases full benefit from temporary pastures or cereals sown for winter feed is not obtained because sowing is not done soon enough. This applies especially to the South Island.

If turnips and swedes have not been sown by the beginning of the New Year this work should be proceeded with as soon as possible, weather permitting. Where rainfall is good, sowing may continue to the end of January, but in most places, after the middle of January, it is safer to depend upon turnips rather than swedes, because turnips come on more quickly and are not so subject to the ravages of insect pests which may appear in summer and autumn. Hardy and Imperial Green Globe are suitable varieties of turnips for January sowing.

Chou moellier, which is of good value for providing winter fodder, may often be sown with success in January. It is of importance that this crop resists club-root attack. Success with all the above-mentioned crops when sown at the periods mentioned is at times largely dependent upon thorough preparatory cultivation of the land.

Potatoes.

Main crops of potatoes should be kept properly cultivated and free from weeds by frequent use of the hoe. No crop repays attention in this respect better than the potato, and especially is this the case if the season is a dry one. Moulding-up of the rows and spraying of the plants should be attended to. As spraying for Irish blight is to be looked upon more as a preventive than as a cure for the disease when established, the spraying should be done during early growth and repeated as required. Advice as to how to prepare efficient sprays is furnished on application to the Department of Agriculture. Certain of the ready-made preparations sold for use in treating potato-blight cannot be depended upon.

Lucerne.

In many districts lucerne may be sown with success up to February. A common error with this crop is to sow the seed, which is relatively small, too deeply; the depth of sowing commonly used with vegetable-seeds is suitable for lucerne. To be able to sow at such a depth uniformly a fine firm seed-bed is necessary. Young lucerne may require mowing towards the end of January. However, it is better not to mow too early, unless weeds are tending to rob the young lucerne-plants of light and nutriment. If conditions sufficiently moist to allow of superphosphate exerting its influence can be expected it is often good practice to top-dress a lucerne-field with superphosphate after it has been mown in midsummer. Superphosphate applied at this time will benefit little if anything except the lucerne, whereas manure applied in spring often benefits not so much the lucerne as invading plants, such as rye-grass, which are in competition with it.

Summer Saving of Soil-water.

In all but the rainiest parts, and more often than is usually thought to be the case, crop-yields are reduced solely because of inadequate supplies of soil-moisture. Some light on the matter may be obtained from the fact that during the growth of a good average crop of mangels about 2,000 tons of water passes from the soil through the leaves of an acre of the crop. Other crops have corresponding requirements. Hence, during summer, surface cultivation of the soil, which assists in checking loss of water from it by evaporation, is of prime importance in the management of those crops, such as mangels, potatoes, and swedes, which are sown in rows wide enough apart to allow of tillage between the rows. Usually this inter-row tillage should be carried out at frequent intervals until the crops have so developed as to have their leaves meeting across the rows. By so attending to intertillage the crop-raiser puts into practice what has been described as "watering with the hoe."

The loose surface layer of soil is known as a soil mulch, and in the case of pastures the place of the soil mulch may fittingly be taken by a plant mulch, if it can be arranged, as a means of checking undue drying-out of the soils upon which the pastures occur. To do this it is necessary not to have the pastures grazed too closely during the dry weather. The growth should be left long enough—consistent with proper grazing control—to have the soil covered as much as possible with leafage, which will act in a way similar to the soil mulch in checking escape of soil-moisture.

Another practical application of the same matter is the fact that land which has been ploughed out of old pasture and which is to be sown in crop in the autumn should be grubbed at intervals during the summer. This summer cultivation work, in relatively dry climates, will not only tend to weaken or destroy troublesome twichy plants such as yarrow, brown-top, sorrel, creeping-fog, and couch-grass, but it will also conserve soil-moisture which may be specially useful to the autumn-sown crop.

Using of Summer Forage Crops.

A fairly common weakness of our farming is that the using of the special summer forage crops is not commenced early enough. In the first place, stock would often be better served in regard to their feed requirements were it remembered that on many farms, from about Christmas onwards for some weeks, while there is plenty of pasture growth available, this growth is usually not altogether suitable for wet stock—it has fallen off in digestibility and is ill-balanced as a ration for milk-production. At this stage great improvement in the ration would result by supplementing the pasture growth with such crops as young green lucerne cut just before it has reached the flowering stage, or with the second growth of an early-mown pasture paddock, or with early-sown quick-maturing soft turnips

which may not have reached their maximum yield but which nevertheless may be used advantageously at this period to maintain the milk-flow. Again, certain summer forage crops, such as lucerne, green millet, &c., are at times allowed to become so mature before being used that they are quite unsuited for milk-production. These crops are at their best for milk-production at a stage corresponding to that at which pastures are at their best for the same purpose—that is, before the woodiness and badly balanced supply of nutriment that comes with flowering has been developed.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

Water-supply for Stock.

A pure and wholesome water-supply is essential for all classes of live-stock. Animals can live much longer without solid food than without water, and an insufficiency of water in the body causes serious disturbances. The processes of mastication, digestion, absorption, and assimilation are hindered; the intestines are not properly flushed, and waste matter remains too long therein. In ruminants, particularly cattle, impaction results, with a consequent decrease in the yield of milk.

Under normal conditions animals consume a fairly uniform quantity of water for each pound of dry matter eaten. Depending on the succulence and composition of the food, so will the demand for water be regulated. Cows require from 3 to 5 gallons of water per day when dry, and about three times that amount when in full milk. Water is also essential in that it regulates the body-temperature; it is given off in the vapour from the lungs and also from the surface of the body.

Stagnant pools are a breeding-place for disease, and liable to surface contamination from the animals themselves. As a water-supply for stock generally these pools must be condemned. They are liable to harbour the eggs of internal parasites of stock, and if the pools are foul they may set up digestive disturbance in the animals.

Concrete watering-troughs for dairy cattle are gradually replacing wooden ones. Concrete troughs when erected should be provided with an outlet at the bottom for purposes of periodically draining and cleaning. The troughs should be conveniently situated in the various paddocks so that the cows may have more time to graze and ruminate. If the animals have to walk some distance for their water-supply they are not so contented, and do not give of their best in regard to milk-yield. This point is very essential, and attention to it will repay the extra cost in a very short time.

As the area around the trough is liable to become waterlogged and boggy in wet weather, it is very desirable to gravel this particular part. If this is done the tendency to foot troubles in the dairy herd is reduced.

—*Live-stock Division.*

THE ORCHARD.

Spraying Operations.

THE rapidly swelling fruit will now require close adherence to the spraying programme, in order to ensure that all portions are kept covered with protective spray material at all times. With crops rapidly approaching the picking-time any easing-up in spraying, although always a temptation, is exceedingly dangerous, with the result of the year's work at stake. A fresh flight of codlin-moth will be on the wing and laying from about the end of the first week in January, and as in some districts showers are frequent about this time the arsenate-of-lead sprays will require close attention.

Black-spot may be expected after periods of humid atmospheric conditions, and pome fruits will need another bordeaux or sulphur spray according to requirements. Precipitated sulphur will now be the dominant spray for apples, the harder commercial lime-sulphur having a tendency to produce burning and russetting.

Red mite usually becomes prevalent with the advent of warmer weather, and if not checked will at least seriously debilitate the trees, and very often check the development of the fruit and cause premature leaf-fall. Its presence is readily detected by the unthrifty, washed-out appearance of the foliage, and closer examination will disclose the presence of numbers of tiny, active, reddish insects mostly on the undersides of the leaves and on the fruit, where the tiny spherical bright-red eggs are laid in the calyx cavity. Control lies in spraying with oil emulsion, 1-100, plus Black Leaf, 40, 1-800, thoroughly wetting the undersides of the leaves and fruit.

Quinces should not be omitted when using fungicides, the application of lime-sulphur, or bordeaux 3-4-50, being necessary for the control of fabraea scald in addition to the lead for codlin-moth and leech or pear-slug.

Sulphur sprays should be continued on stone-fruits up to about a fortnight prior to picking.

Thinning.

The main thinning should now be well advanced, and a fair estimate can be made of the amount of fruit left to develop. If the development of the early-ripening varieties has been retarded through unfavourable conditions due to dry weather or insufficient thinning it will be found beneficial to thin still further, so as to encourage development in the short time that remains before picking commences, and reduce the quantity of what would otherwise be undersized fruit. Late flowering in Jonathans is sometimes responsible for more fruit than is desirable being left, and a second thinning can be done with advantage.

Budding.

From early in January onwards budding may be proceeded with, either on young stocks grown for the purpose or on trees where grafts have missed. Firm current season's wood is more satisfactory to bud into, but this cannot always be found in the desired position and it becomes necessary to resort to older wood, when, provided that the tree is vigorous and the bark is in good condition, satisfactory results can be obtained. However, fresh, hard, young growth should be selected if possible.

T or shield budding is almost universally adopted. One of the essentials is to have a thoroughly sharp smooth edge on the knife. It will be found that, in taking the bud, commencing the cut on the lower side and working upwards towards the tip of the shoot has some advantages over the reverse procedure. With stocks in good condition—that is, when the bark is lifting readily—when the perpendicular cut in the stock reaches the transverse cut previously made, a slight sideways twist with the point of the knife will be all that is necessary to raise the bark sufficiently to permit the insertion of the bud. Having been cut from the bottom, that portion of the bud will be stiff enough to be pushed down into position, and only sufficient bark to accommodate the bud will have been displaced. If possible, opening the bark for the full length of the cut, either with the blade or the handle of the knife, should be avoided, as the wound will extend further than is necessary and the injury to the delicate plant-tissue will retard the union.

Probably the two most common causes of failure, apart from unfavourable conditions in the stock, are slow working, causing the exposed surface

to dry, or cutting the bud too thick. The cut should be only deep enough to include the bud and a trace of the underlying wood. Any excess of wood should be removed, commencing from above the bud and peeling downwards. This will leave just sufficient wood in the eye to give rise to new growth. If the removal of the wood is commenced from below the bud the wood in the eye may pull out, leaving only a hollow shell of bark that will not start into growth. After inserting the bud any portion projecting beyond the top cut should be removed, and the whole firmly tied with raffia or other suitable material to bring the parts into close contact and exclude the air and moisture.

Cultivation and Cover-crops.

The continuation of cultivation will not be practicable for much longer, and consideration of cover-crops should receive attention. For this purpose blue lupins are generally sown from November onwards, according to weather conditions and locality. Sowing for grazing purposes can be proceeded with, and a mixture, sown at the rate of about 15 lb. per acre, of Western Wulfs or Italian rye-grass and prairie-grass should provide grazing for hoggets during the winter months as well as suppressing weeds, making a better sod for spring ploughing, and increasing the humus-content of the soil.

Citrus-culture.

The heavy frosts which were recently experienced in some districts will necessitate a certain amount of attention to trees to correct the clustered condition of the young growth consequent upon the destruction of the apical buds. Only such shoots as are required for terminal extension should be retained, and the remainder removed to ensure satisfactory development in the desired positions. Failure to limit the number of growing-points not only produces undesirable crowding, but frequently results in the tree making very little progress for two or three seasons until the most favourably situated shoot asserts itself and definitely takes a lead.

Young freshly planted trees should be gone over to remove any shoots starting from low down on the stem and anything which may develop into a secondary stem. For future handling it is important that the trees should have only one well-defined stem, of sufficient height to place the first fork well above the ground, and if the shoots are rubbed out before they harden the liability to infection by wound parasites is greatly reduced. The successful treatment of collar-rot and other bark-diseases is rendered much more difficult where crutches low down afford lodgment for disease spores, soil particles, and moisture.

Young borers will now be active, and should be treated before their operations become extensive. They may be located by their castings; small affected twigs should be removed and burned, and larger ones treated by injecting benzine into the holes and plugging with soap or putty.

Fruit should now be reaching the setting stage, and an application of a quick-acting nitrogenous manure, preferably during showery weather, is generally beneficial in carrying over the critical period.

Repeat the application of bordeaux where necessary, in order to maintain a cover against grey scab and verrucosis on young fruit or foliage. For insect control oil, 1-160, or Black Leaf 40, 1-800, may be used. When using Black Leaf 40 alone, soap at about 3 lb. to 100 gallons should be added to improve the spread and adhesiveness.

—G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Precautions against Vermin.

As the time has now arrived when hot weather may be expected, it is important that a keen eye should be kept for the presence of vermin. This is essentially the best time to take steps for the destruction of these parasites, for it is during hot weather that they are apt to show up and multiply at an alarming rate. The best method of dealing with vermin is to prevent them from making their appearance. This implies strict attention to cleanliness, the provision of good dusting-places, periodical sprayings of the houses with strong disinfectant, and the application of Black Leaf 40 to the perches.

Keeping the nest-boxes free from broody hens is another matter which must not be overlooked. To allow birds to sit on the nests day after day not only encourages insect pests, but it also means a loss in eggs and reduced profits. The houses should be visited nightly, and any birds found on the nests should be removed to the broody-coop. The common mistake should not be made of starving the broody hen. If eggs are to be produced in the shortest space of time, ample food of the best quality should be provided.

Green Feed.

Every effort should be made to provide an abundant supply of green material for autumn and winter use. Green feed serves a threefold purpose: it not only keeps the fowls in good health and gives the yolk of eggs the desired rich colour, but it materially assists in reducing the grain bill, and thereby makes for economical production. It cannot be too strongly emphasized that for young stock to make the best growth they must never receive a set-back, and one of the worst checks to healthy development is lack of green stuff during the growing-stage. Silver-beet is an excellent thing to grow for poultry, and is a heavy cropper. Any of the cabbage family, including rape, or, alternatively, mangels, carrots, and green oats, may be grown to advantage.

Culling.

Many requests have been received from poultry-keepers for the Poultry Instructors to pay them visits early in the New Year, for the purpose of giving advice and assistance in regard to culling their flocks. This is not such a simple matter to carry out as it may appear to the inexperienced. In successful poultry-keeping there is a time for everything, but the present is certainly not the time for the general culling of a flock to be carried out. Such culling should have been done last March, or be left until the same month next year. It is only towards the end of the laying-season—in other words, just before the moulting process takes place—that even the keenest judges of form can distinguish between the bird that will be profitable and the one which will not.

While advising that the main work of culling should be deferred until autumn, it must not be inferred that the weeding-out of undesirable stock should be left entirely to that period of the year, as odd birds may, to the advantage of the plant, be weeded out at all periods of the year. Culling may even commence during the first months of maturity, for it is useless to expect a weak-constituted bird to turn out profitable; again, there are always freaks and throwbacks from the best matings which will never develop into satisfactory stock.

Though this is the case, it is almost impossible at this period of the year to satisfactorily cull a laying flock. The only guide to successful culling is the appearance of the birds, except, of course, where individual egg records are kept by means of trap-nests, &c. Usually the bird well above the

average weight of the breed is the drone, but even in this case it may be a mistake to discard her, as the overweight may merely be the result of an enforced rest. Then, again, at the present time a number of birds will be taking a rest and will have signs indicating poor egg-capacity, such as shabby appearance, worn plumage, and more or less shrinking of the comb and the abdominal region, but in these cases it may be merely a prelude to a heavy laying-period in the late summer and autumn. It can therefore be seen how difficult it is to distinguish between the two classes of birds—the poor layer, and the heavy layer which has just experienced an exhausting laying-period and is preparing for further egg-production.

It may generally be taken as a good guide that the thinnest birds, showing a rough and shabby appearance, including bare heads, from now on to moulting-time are the heaviest layers in the flock. Unfortunately, many poultry-keepers do not realize this, and as a result a keen student of laying form visiting the average auction-mart cannot fail to see some of the best laying-types of birds in the country being marketed long before they have finished their best season of production, this being due solely to their rough appearance, and to ignorance on the part of their owners in not knowing that the appearance of the birds is entirely due to heavy egg-production.

I would again emphasize that it is a mistake to cull at any time birds that give indications of laying-power, such as the absence of any signs of moulting, the presence of a red comb, a fullness of the abdomen, and an active businesslike appearance, even if they do have a shabby appearance.

The Pullet for Winter Production.

A correspondent has asked my advice as to the feasibility of inducing his birds to moult during the early autumn, with the idea of their laying better during the winter months. In my opinion the proposal has nothing whatever to recommend it. This is one of the many things in connection with poultry which sound well theoretically, but which seldom or never prove of value when put to a practical test. It is an easy matter to induce a false moult, and, provided the birds are well fed and managed after moulting, they will come into profit at a time when the egg-market commences to rise. Usually, however, they will moult again at the ordinary season and cease to lay. In the management of laying-birds experience shows that the less one interferes with the natural course of things the better. For winter egg-production there can be no doubt that the pullet is the most desirable bird; and if a maximum of profit is to be secured the pullet should be kept going from the time she reaches maturity, forcing every egg out of her until her period is completed, irrespective of season and the price of eggs. Naturally this would not apply in the case of a bird intended for future breeding purposes.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Returning Swarms to Parent Colonies.

SWARMS in January are of little value except as increase for next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the colony is cramped an extra super may be given, and with this induce the colony will usually settle down at once to work.

After-swarms should always be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin

queen or queens can easily be picked out as they attempt to force their way through, and once these are removed the bees will return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frame, when she will be accepted by the bees.

Ventilation.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air by day and night. All weeds and other obstructions should be removed from the front of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should the bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colony.

Handling of Supers.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen will allow his bees to loaf or cluster outside the hives for lack of storage room. It is well when adding additional supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should, be understood however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work on the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not yet hatched—it is an excellent plan to tier up with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

Use of Queen-excluders

January is the month when queen-excluders are of most use to the beekeeper, especially in South Island districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens, the queen-cells should be destroyed, as the queens which will emerge from them will not

be able to pass through the excluders to get mated, and will in time develop into drone-layers. By providing the queen with plenty of empty combs she will be able to continue laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Queen-excluders are often condemned as being productive of overswarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers is carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Tobacco Crop.

THE early tobacco crop is now approaching maturity, and preparations for the harvest should receive close attention, as the efficient and economical curing of a crop demands very careful organization to carry it through successfully with the usual facilities available. The chief limiting factor in tobacco-growing is the shed accommodation for curing the leaf. This is generally rather small for the quantity to be treated, and for this reason manipulation must be carefully studied to use it to best advantage. A good supply of curing-sticks will be required—about 700 per acre for air-curing on the stalks. These sticks should be 4 ft. 3 in. long and sufficiently strong for the purpose. Too often a number of weak sticks are used; these bend with the weight, and being thus shortened slip from the tier-poles, damage the leaf, and give unnecessary work.

The usual shed accommodation is quite suitable for curing the early crop, but for later crops, and especially in districts with a humid climate, a building that is sufficiently close to exclude fogs and low temperatures when necessary is required. Where corrugated-iron sheds are used it is important that sufficient ventilation should be available in the gables and roof of the building. Buildings with a shingle roof in poor condition should receive attention if they are to be used for curing tobacco-leaf, otherwise drips in wet weather will do great damage and make good work impossible. It is important that the sheds should be thoroughly clean and dry, and free from any decaying vegetable matter, otherwise moulds are sure to occur. Under suitable conditions that are occasionally unavoidable moulds will infect the leaf with disease, which is the chief trouble to be guarded against in this operation. Sufficient tier-poles and posts on which to hang the sticks of tobacco will be required, and they should be strongly bolted into position. As this scaffolding has often to carry the weight of men who are filling the shed the timbers should be carefully inspected to see they are amply strong for the purpose, and so avoid what may easily be a very serious accident. About 14,000 cubic feet of shed room is required to cure an acre's produce of leaf on the stalks, and about half that space if the single-leaf system is adopted.

Perhaps the most important part of the necessary equipment for the successful handling of tobacco-leaf is a thoroughly clean, warm, dry room in which to bulk it down after curing. Too often well-cured leaf is left hanging in the sheds until the humid cold weather of late autumn depreciates its colour, texture, aroma, and flavour, and even moulds become established. Most important is it that leaf should be bulked down as soon

as it is properly cured, and this should be done in such a room as described, as only under such conditions will its quality be maintained, and indeed improved. Such a room should have a well-ceiled roof; bare corrugated iron is unsuitable, as it collects moisture in cold weather. This practice not only gives leaf of a better quality, but by economizing the space in the curing-shed permits of a greater quantity being handled.

Tomatoes.

Towards the end of January the bulk of the outside tomato crop commences to mature, and early in February it is well established on the market. In view of this fact the grower with a crop under glass should now give it close attention to make the most of the market opportunities before the outdoor crop arrives. The progress of the maturing crop may be assisted by feeding fortnightly with liquid fertilizers, and careful attention should be given to watering and ventilation, to keep the plants in general good health and avoid an attack of leaf-mould or other diseases which check the development of the fruit.

The outside crop will now require careful supervision, so as to note the first signs of any disease which may attack the crop, and to promptly deal with it. As the crop ripens and picking commences, moderate dressings of fertilizers, including nitrates, may be given to help development. Sometimes this is given too generously, which is very unwise, as it is not only a financial waste but is frequently harmful by predisposing the crop to disease.

There are many encouraging signs of improvement in the packing and marketing of this important crop. There are still a few, however, who pack fruit of mixed stages of maturity, and sometimes even immature fruit. Such a practice makes the general retail price high, and further discourages sales by giving the consumers who buy it a distaste for the fruit at the beginning of the season, as immature fruit of this class never develops the full flavour and appearance that makes it really attractive. It is to the grower's interest not merely to sell his crop, but to make the goods popular and create a good demand by delivering the fruit so that it may be sold in first-class condition. Trade in these goods would no doubt greatly increase if the small section of growers who pack immature fruit and poor types were to improve their practice. Coloured fruit and mature fruit of good quality should be packed in separate boxes and labelled accordingly; other kinds should be discarded.

Small-fruits.

Among the small-fruit crops attention should be given to the plants as soon as the harvest is over. The fruiting-caness of raspberries and loganberries should then be cut at the surface of the ground and carried out and burnt. Strawberry-beds should have the longest straw removed, be cleaned of weeds and runners, and given a light cultivation to encourage autumn growth. Gooseberries and currants, white and red, may be summer pruned by removing the stronger young growth that may be crowding the centre of the plants; some even recommend that the old fruiting-wood in black currants should be cut out now. If this pruning is followed up with such spraying as may be necessary, the plantation should have clean, ripe, strong growth for next season's cropping.

The Market-garden.

In districts subject to late blight the potato crop should now be sprayed at intervals of two to three weeks. Select sets of early potatoes from the best roots only, and while ripening them see they are not exposed at night in fine weather to the attack of the potato-moth.

The planting of the winter-crops of savoy, cauliflower, broccoli, leeks, and celery should now be completed. In dry districts celery should be

planted in the usual trenches and kept well watered, but in more humid localities and on moist rich soil it may be planted in shallow drills, and later blanched by earthing up or by means of 12-in. boards placed along each side of the rows. When these winter crops are established a small dressing of nitrate of soda may be given to keep them moving.

The leading growth of marrows and pumpkins should have the point removed to encourage the formation of fruiting laterals, also the growth thinned generally to avoid crowding. Marrows are best cut as soon as they are big enough; the larger sizes are not in good demand. Remember plants of this class like plenty of water on a well-drained soil.

Rhubarb and asparagus beds now require a good dressing of manure and fertilizers to encourage a vigorous growth, in order to put them in strong condition for next season's cropping. From now on the cutting and pulling of sticks should cease, and the plants be allowed to make their natural growth.

For late crops sow now peas of a variety known as "early," kidney beans, lettuce to mature without transplanting, turnips, spinach, turnip-rooted beet, and shorthorn carrots.

The Homestead Garden and Shelter-belts.

Where new gardens are being made the final preparation of the land should now be done; especially should it be cleaned of twitch and bad weeds. The cultivation of the soil and grading of the surface should be done in good time, so that the ground may settle and consolidate before the surface is raked smooth and sown with grass-seeds early in March.

The planting season for hard-wooded plants will commence in the month of May. In preparation one's requirements of this kind should now be carefully studied, as successful planting depends on thoughtful planning more than on any other factor. In local public gardens, nurseries, and the locality generally one may study plants of all kinds that may be desirable for any purpose, shelter or ornament, for flowers or fruit, trees, shrubs, and climbing-vines. We have one of the best climates and soils for production of this class, and the wonder is we do not take more advantage of our great opportunities of this kind.

A New Bird-scare.

Reports from America state it has been proved that birds have a particular dislike for blue material. Seed-beds may be effectively protected by "kite-tails" made from bright blue paper, and fruit-trees and shrubs may have the crop preserved by tying in strips of cloth or paper at intervals. The battle with the birds is often a strenuous fight, but it will be an easy success if one can protect the strawberry beds with flags of bright-blue paper in cleft sticks.

---W. C. Hyde, Horticulturist, Wellington.

Control of Diamond-backed Moth.—As is well known to farmers, the larvæ of this moth are particularly destructive in cruciferous crops grown throughout the country. With a view to biological control it has been deemed essential by the Plant Research Station at Palmerston North to ascertain the different species of parasites and hyper-parasites (if any) already here. This phase of the work is now well advanced, and specimens of the parasites obtained have been forwarded to the Imperial Bureau of Entomology, London, for specific identification. The life-history of the moth is also being studied.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR NOVEMBER, 1929.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.						
		Yrs. dys.	lb.	lb.	lb *	
<i>Junior Two-year-old.</i>						
Clara ..	Truby King, Stratford ..	1 342	240.5	365	10,678.3	616.54
Totara Bank Lady Betty	W. D. Dron, Nelson ..	1 364	240.5	365	10,630.6	594.38
Claribel of Oaklands..	Truby King, Stratford ..	1 352	240.5	365	9,844.6	536.90
Admore Flirt ..	R. A. Lewis, Dargaville ..	1 341	240.5	365	9,781.4	508.99
Orange Vale Wireless	Estate of W. J. Hall and Son, Matatoki	2 21	242.6	365	9,200.7	474.64
Oak Farm Sylvian ..	G. B. Knowles, Tariki ..	2 10	241.5	365	7,781.3	472.56
Oak Farm Joan ..	G. B. Knowles, Tariki ..	2 5	241.0	360	8,144.2	459.54
Ku Ku Elegance ..	R. L. Horn, Ohau ..	2 8	241.3	365	8,190.1	457.48
Tauwhare Doon ..	Dr. C. G. Aickin, Auckland	2 4	240.9	365	8,623.5	449.16
Tauwhare Pansy ..	Dr. C. G. Aickin, Auckland	1 347	240.5	365	7,890.5	445.91
Oak Farm Pal o' Mine	G. B. Knowles, Tariki ..	1 356	240.5	365	7,950.1	443.35
Dellside Heatherbell..	A. N. Griffin, Richmond ..	1 279	240.5	365	7,469.9	434.68
Tauwhare Aster Queen	Dr. C. G. Aickin, Auckland ..	1 343	240.5	365	8,087.0	431.06
Oak Farm Rosary ..	G. B. Knowles, Tariki ..	1 314	240.5	365	8,198.2	421.51
Bluebird's Lassie ..	H. Hyland, Hastings ..	2 1	240.6	365	7,775.0	415.16
Penzance Lilac ..	F. P. King, Cambridge ..	2 68	247.3	340	7,917.5	413.96
Ku Ku Gleam ..	R. L. Horn, Ohau ..	2 30	243.5	343	8,265.5	409.14
Jerseydale Stylish ..	John Pettigrew, Pihama ..	2 17	242.2	365	7,779.7	388.28
Royton Eileen ..	F. B. Starky, Opotiki ..	1 363	240.5	365	6,341.8	387.19
Brookley Melba ..	W. Johnson, Ngaere ..	1 354	240.5	313	6,523.8	353.19
Royton Effie ..	Mrs. I. W. Spiers, Levin ..	2 5	241.0	362	7,008.8	343.20
Awapuni Winnie ..	W. Devine, Palmerston N.	1 346	240.5	295	5,576.6	311.13
Arthingworth Midgie	E. Smallbone, Richmond ..	1 345	240.5	336	6,283.7	302.58
Elpin Grange Lady Astor	E. S. Walker, Stratford ..	1 306	240.5	325	5,433.4	302.35
Brookley Poppy ..	E. W. Jacobs, Horotiu ..	2 47	245.2	304	4,983.6	295.73
Viola's Golden Mirnee	Mrs. A. Jagger, Papakura ..	2 12	241.7	313	5,849.4	295.35
Marshlands Dark Maiden	W. Archer, Invercargill ..	2 17	242.2	345	4,561.2	267.14
Bethune Andre ..	A. S. W. Hazard, Waimate North	2 22	242.7	226	5,470.0	265.29
Burrwood Victress ..	J. B. Tonar and Son, Northcote	1 327	240.5	353	5,146.3	263.45
<i>Senior Two-year-old.</i>						
Promise's Lady ..	Mrs. L. A. Turner, Riverlea ..	2 325	273.0	353	10,486.3	578.37
Wairua Frenzy ..	A. L. Dermer, Feilding ..	2 342	274.7	365	10,389.0	558.32
Wairua Frivolity ..	A. L. Dermer, Feilding ..	2 337	274.2	365	9,038.9	522.83
Wairua Camelia ..	A. L. Dermer, Feilding ..	2 358	276.3	365	9,244.3	521.07
Clendon Pretty Mary	H. Peoples, Drury ..	2 363	276.8	365	7,271.3	520.50
Countess Clematis ..	R. Fleming, Waimana ..	2 359	276.4	365	10,170.8	517.15
Cowslip of Stonycroft	S. Unwin, Winchester ..	2 269	267.4	365	7,461.8	454.55
Bethune Dorothy ..	A. S. W. Hazard, Waimate North	2 306	271.1	365	7,543.9	432.38
Ratavale Frisky Maid	Mrs. I. W. Spiers, Levin ..	2 111	251.6	343	6,933.4	385.90
<i>Three-year-old.</i>						
Wellfield Skylark ..	W. J. Murray, Otakiri ..	3 23	279.3	365	10,996.2	779.95
Wellfield Queenie ..	W. J. Murray, Otakiri ..	3 19	278.9	365	11,130.7	657.73
Huia Joyful ..	H. G. Lever, Tauranga ..	3 320	309.0	365	10,599.4	554.32

LIST OF RECORDS—continued

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cent.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—continued						
Three-year-old—contd		Yrs. dys.	lb.		lb.	lb.
Mauriaena Fleur-de-lys	T. and A. Smith, Otorohanga	3 336	310.6	365	10,072.4	544.03
Ratavale Ideal	Mrs I. W. Spiers, Levin ..	3 82	285.2	361	10,298.4	538.60
Waiora Mayflower ..	A. E. Peppercorn, Cambridge	3 32	280.2	365	8,301.6	505.22
Wairua Caramel ..	A. L. Dermer, Feilding ..	3 40	281.0	365	7,355.7	488.45
Clifton Some Eileen ..	Mrs. A. Jagger, Papakura	3 80	285.0	316	7,533.1	453.48
Arthingworth Josephine	E. Smallbone, Richmond ..	3 322	309.2	365	8,740.9	409.02
Four-year-old						
Wellfield Legacy ..	W J Murray, Otakiri ..	4 286	342.1	365	11,388.5	693.29
Woodnook Dawn ..	J A Moffat, Turiwiri ..	4 7	314.2	365	11,139.2	617.41
Ivondale Marigold ..	Dr. C. G. Aickin, Auckland	4 351	348.6	365	10,342.0	561.82
Maid's Joy ..	H. G. Lever, Tauranga ..	4 351	348.6	305	10,820.1	550.46
Eileen's Countess ..	R. Fleming, Waimana ..	4 316	345.1	365	9,109.3	526.41
Tyrone Girl ..	R. J. Johnston, Runciman	4 278	341.3	363	7,889.1	502.56
Manor Hussy's Island Queen	J. B. Tonar and Son, Northcote	4 209	334.4	305	7,624.0	417.81
Beata of Aria	M V Reeve-Smith, Aria ..	4 360	349.5	288	7,435.6	402.42
Belvedere Radianta ..	R. W. Ferris, Tokomaru ..	4 363	349.8	327	6,998.1	363.78
Mature.						
Wairua Carmania ..	A. L. Dermer, Feilding ..	5 315	350.0	365	10,387.2	626.36
Earlston Lily ..	Chisholm Bros., Hunterville	6 16	350.0	365	10,156.1	598.30
Wairua Frauline ..	A. L. Dermer, Feilding ..	5 326	350.0	365	10,289.8	588.19
Vixen's Golden Ray ..	R. E. Clements, Awakino Pt.	6 358	350.0	365	10,649.3	581.36
Rockview Princess ..	W. H. Fitness, Rehua ..	6 273	350.0	365	9,382.1	565.77
Wairua Frano ..	A. L. Dermer, Feilding ..	7 310	350.0	365	10,485.0	563.78
Mere Whitu ..	F. S. McKee, Palmerston N.	5 329	350.0	355	10,423.0	562.64
Ornelton Heather Bell	W. Archer, Waukiwi ..	11 79	350.0	364	10,646.7	541.76
Fair View Meadow ..	A. Hazelton, Waihou ..	7 364	350.0	344	10,101.6	540.05
Seachiff Marigold ..	H. Robson, Hamilton ..	5 31	350.0	330	8,916.1	539.54
Beresford Belle ..	T. Brownlee, Pukekohe ..	6 29	350.0	266	8,629.8	532.86
Fawn Princess ..	Truby King, Stratford ..	7 344	350.0	305	10,233.9	516.78
Wairua Sprite ..	A. L. Dermer, Feilding ..	5 360	350.0	310	9,376.2	512.42
Earlston Peggy ..	Chisholm Bros., Hunterville	6 25	350.0	340	9,262.0	508.53
Beanbah Pet ..	Mrs A. Jagger, Papakura ..	5 330	350.0	338	8,334.9	491.80
Roslyn Sweet Love ..	Mrs A. Jagger, Papakura ..	9 13	350.0	332	8,713.4	489.77
Arden Viola's Bess ..	R. W. Ferris, Tokomaru ..	5 292	350.0	365	7,439.2	467.13
Jersey Meadows Princess	Mrs. I. W. Spiers, Levin ..	6 18	350.0	338	8,751.5	464.27
Belvedere Radiance ..	R. W. Ferris, Tokomaru ..	6 338	350.0	334	9,339.9	463.46
Silvery Sea ..	H. G. Lever, Tauranga ..	6 301	350.0	365	7,908.7	462.35
Rosemont Lady's Maid	Mrs. V. I. Gunson, Tauraroa	5 22	350.0	365	9,634.0	460.05
Rosemont Sybil ..	Mrs. V. I. Gunson, Tauraroa	5 22	350.0	344	8,283.4	457.49
Rylands Golden Sunrise	A. S. W. Hazard, Waimate North	5 1	350.0	332	8,150.9	440.83
Middlewood Twinkle	J. A. Cornfoot, Feilding ..	5 29	350.0	305	7,707.7	424.47
Rosedale Lilian ..	R. J. Johnston, Runciman	5 85	350.0	306	7,645.2	411.70
Rockview Ruby ..	W. H. Fitness, Rehua ..	8 30	350.0	287	7,107.7	400.35
Ebors Champagne ..	R. J. Wilson, Putaruru ..	5 323	350.0	305	7,321.6	381.42

FRIESIANS.

<i>Senior Two-year-old.</i>						
Rosevale Colantha Korndyke	H. W. Birch, Roxburgh ..	2 306	271.1	347	9,900.4	342.39

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season		
				Days.	Milk.	Fat.
FRIESIANS—continued.						
Senior Three-year-old. Omaha Cordylne Vola Paxton	A. Migounoff, Matakana ..	Yrs. dys. 3 363	lb. 313·3	168	8,791·7	327·63
Junior Four-year-old Mahoe Netherland Astelia	R. A. Wilson, Bulls ..	4 6	314·1	336	12,470·6	470·00
Senior Four-year-old. Livingstone Lady Wakalona*	W. J. Eames, Hunterville ..	4 242	337·7	272	15,402·9	614·19
Mature. Ivy Netherland Pietertie	T. O. Hodgson Estate, Tamahere	5 58	350·0	345	17,932·4	593·33

MILKING SHORTHORNS.

<i>Junior Two-year-old.</i> Glenthorpe Lady 3rd	Black Bros., Whakatane ..	2 56	246·1	253	10,098·5	417·52
<i>Mature.</i> Riverdale Florrie 3rd	T. W. Wardlaw, Waimana	6 267	350·0	365	16,856·2	681·09
Stockton, Molly ..	W. E. G. Holland, Edgumbe	7 12	350·0	335	11,267·1	424·10
Naumai Melba ..	R. F. Baguley, Naumai ..	6 173	350·0	344	9,573·0	390·38

AYRSHIRES.

<i>Three-year-old.</i> Fair Lass of Greenbank	W. Moore, Masterton ..	3 267	303·7	365	16,110·4	639·85
Greenfields Marilyn ..	C. E. C. Webb, Levin ..	3 18	278·8	346	7,701·5	301·46
<i>Mature.</i> Elims Rowena ..	A. R. Claridge, Toko ..	9 297	350·0	365	11,653·9	517·49

RED POLLS.

<i>Two-year-old.</i> Glen Eden Queenie ..	J. G. Donaldson, Stirling ..	2 105	251·0	365	7,501·9	308·45
<i>Three-year-old.</i> Glen Eden Tablemaid	J. G. Donaldson, Stirling ..	3 8	277·8	365	7,282·9	308·28
<i>Mature.</i> Wayward 6th B No. 1	G. S. Young, West Plains ..	6 349	350·0	365	11,404·8	536·50

*Second-class Certificates.***Jerseys.**

<i>Junior Two-year-old.</i> Flaxmoor Twilight ..	M. A. Jennings, Mauriceville	2 16	242·1	365	7,574·4	415·57
<i>Senior Two-year-old.</i> Jerseydale Colleen ..	John Pettigrew, Pihama ..	2 300	270·5	365	7,856·3	396·36
Rosedale Fancy Fox	E. J. Adams, Puni ..	2 359	276·4	365	6,699·2	314·83
<i>Four-year-old.</i> Rewa San Fan ..	R. W. Ferris, Tokomaru ..	4 285	342·0	365	7,493·6	411·19

THE DEER PEST: ACTION BY STATE FOREST SERVICE.

THE annual report of the Director of Forestry (Mr. E. Phillips Turner) for 1928-29 refers to the deer pest as follows:—

The payment of a bounty of 2s. per tail has been continued during the year. In Nelson Region 2,564 tails were received; in Southland, 3,370; Canterbury-Otago, 3,837; Westland, 560. Fifty-three red deer were also destroyed in Golden Downs Plantation, Nelson; 41 were shot in the Rotorua plantations, and 70 on Stewart Island: a total for the year of 10,495.

The establishment of "salt licks" has not yet proved successful in indigenous forests, but there is definite evidence that deer are attracted to the licks in the exotic plantations.

Deer-destruction is now being carried out systematically by parties under Forest officers in all infested areas. Assistance is being given by exporters in testing the world's markets for the utilization of hides, horns, and venison, with a view to enhancing the commercial value of the pest and in order that a reduction in numbers may be achieved at as low a cost as possible.

An official party was engaged in the Lilburn Valley, Southland Region, for a period of three months, during which time 353 red deer were destroyed. In the Blue Mountains Plantation (Canterbury-Otago Region), in which the depredations of fallow deer have been very severe, an official party during a period of three weeks shot approximately four hundred. An official shooting party is at present being organized in the southern portion of the Nelson region. The anticipated result of this experiment is the destruction of a further one thousand deer. The Service has made arrangements in this region to collect deer-hides and to forward them to various exporters in an endeavour to increase the demand overseas.

The sale value of red-deer hides ranges from 4s. to 5s. 3d. each, according to size and the method of fleshing and drying. There is undoubtedly a good market for medium-sized well-dried red-deer hides for utilization in fine leather-work. Certain overseas manufacturers have been favourably impressed with the qualities of these hides, and it is anticipated that values will increase in the near future. An experimental shipment of fallow-deer hides was also made, but so far the results have not been successful as a business proposition. Fresh avenues, however, are now being explored.

There is no doubt that at the present time deer constitute the most serious menace to the State-owned forests, and in consequence of their great numbers the forest-floor has in many places been completely destroyed. In many parts of New Zealand regeneration has disappeared, and the plants which furnish most of the honey and berries upon which native birds subsist have been completely destroyed. Deer-destruction has not yet overtaken the annual increase of the herds, malformation is prominent, and good heads are not obtainable in many districts.

Probably the damage is most apparent in high country, above the bush line. The major alpine plants are obviously a staple diet, and the formation of screes at the headwaters of snow-fed rivers is accelerated and increased in area by the removal of this vegetation. Increased erosion and larger deposits of detritus on low country are the direct result. The true remedy for much of the present high-country erosion, particularly in Canterbury, is afforestation with high-altitude species for protection purposes. This remedy is quite impossible of application in deer-infested country, as the young trees are immediately eaten out.

Notwithstanding the efforts made by some of the acclimatization societies to control this pest, it has reached such proportions and constitutes such a grave danger to the perpetuation of our native flora and fauna that it is now a national problem and should be nationally controlled.

From the purely departmental point of view, it would appear that the Forest Service is carrying the chief financial burden of deer-control, and this expenditure must be reflected in the future cost of timber from exotic plantations.

Control of Fireblight.—Amending regulations for the better control of fireblight, gazetted on 3rd October, add cotoneaster and medlar to the list of plants the removal of which from any part of the Dominion to another is prohibited.

WEATHER RECORDS : NOVEMBER, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

AFTER a long dry spell, rainy conditions had set in over a large part of the country at the end of October. These continued throughout November, which proved a dull and humid month. Heavy rains were recorded in many districts, some places having the wettest November for many years. The totals for the month were below the normal in the low-lying country facing the Taranaki Bight from Patea to Foxton, in the Wairarapa, and on the Plains country of Canterbury and North Otago. Elsewhere there was an excess that was in most cases considerable. At Auckland, Tairua, Nelson, and Clyde the rain was more than double the average for November, while at Tauranga and Maraehako Station, near Opotiki, it was approximately double.

Temperatures, though there was much warm and humid weather, were, on the average, below normal, especially over the South Island. Sunshine records were also low, while the amount of cloud was correspondingly high.

There was more wind than usual, north-westerlies predominating. In this respect the previous absence of westerlies was to some extent counter-balanced, and a more normal type of spring weather experienced. Most of the rain fell in the north-westerlies, comparatively little being brought by the southerlies, which were rather poorly developed. This fact accounted for the continued dry conditions in some areas.

There were two principal storm periods, the first being from the 1st to the 9th, during which two cyclonic depressions crossed the Dominion, the first over Otago and the second over Auckland. Rain was general, and many heavy falls were recorded in the North Island and western districts. In the central part of the North Island particularly this was a very warm, humid, and rainy spell. On the 6th a sudden thunderstorm and a heavy downpour occurred at Crushington, near Reefton, where some of the creeks were flooded. On the 8th there was a flood in the Wairau River caused by the heavy rain in the back country. On the 9th particularly severe thunderstorms accompanied by exceptionally heavy rains occurred over a large part of the north central portion of the North Island. Flooding was reported from Auckland as far north as Whangarei, in the Lower Thames Valley, and in the Napier district. There were several instances of stock being killed by lightning, and a house near Hastings was struck. In parts of the Coromandel Ranges the rain amounted to a deluge. At the Ohinemuri mines, near Paeroa, a wall of water 14 ft. high came down one of the creeks, and extensive damage was done, one life being lost. Following this, from the 10th to the 12th, occurred one of the finest spells in the month.

In the rear of a westerly depression which passed on the 14th, gales were experienced generally on the 15th and 16th. In Cook Strait they were from the north-west, but elsewhere from the south-west. Snow fell on the ranges on the morning of the 16th, reaching the lower levels at Greymouth, the Bluff, and Nugget Point. A severe frost was experienced in the morning in parts of the South Island, especially North Canterbury, where much damage was done to gardens, fruit, and small crops; Nelson also suffered considerably.

The second of the stormiest periods referred to above was that from the 26th to the end of the month, when a double-centred cyclone crossed the South Island. West or north-west gales occurred from Cook Strait northward, accompanied by heavy rains. In the South Island, also, the rain was general, but only light to moderate in the eastern districts. Again there

were many severe thunderstorms. An interesting feature was another copious deposit of red dust from Australia over a wide area in Taranaki, western Wellington, Nelson, and Marlborough.

RAINFALL FOR NOVEMBER, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitiaki	5.54	15	1.25	3.27
2	Russell	3.01	12	0.90	2.52
3	Whangarei	3.82	11	0.94	3.04
4	Auckland	7.09	19	2.02	3.26
5	Hamilton	6.50	18	1.46	4.04
5A	Rotorua	9.77	17	1.31	4.10
6	Kawhia	6.51	19	1.26	4.69
7	New Plymouth	6.15	19	1.37	4.65
8	Riversdale, Inglewood	12.60	19	4.20	8.95
9	Whangamomona	10.36	20	1.65	7.29
10	Eltham	6.14	17	1.46	3.35
11	Tairua	9.52	12	2.18	3.96
12	Tauranga	6.57	17	1.17	3.29
13	Marachako Stn., Raukokore	5.96	18	1.22	3.04
14	Gisborne	2.96	8	0.96	3.02
15	Taupo	4.86	14	0.88	3.43
16	Napier	3.85	8	1.28	2.51
17	Maraekakaho Stn., Hastings	3.55	14	1.25	2.03
18	Taihape	2.92	14	0.82	3.69
19	Masterton	1.06	11	0.22	2.73
20	Patea	3.32	14	0.72	3.91
21	Wanganui	3.12	9	0.75	3.18
22	Foxton	2.12	11	0.50	3.24
23	Wellington (Karori Reservoir)	3.44	14	1.40	3.04
<i>South Island.</i>					
24	Westport	8.00	18	1.88	7.08
25	Greymouth	14.51	19	2.50	9.13
26	Hokitika	15.43	21	2.04	10.73
27	Ross	20.47	20	3.27	13.94
28	Arthur's Pass	19.16	16	4.12	15.50
29	Okuru, S. Westland	13.22	15	2.18	12.96
30	Collingwood .. ..	..	..	..	7.68
31	Nelson	6.91	13	2.56	2.93
32	Spring Creek, Blenheim	3.77	10	1.60	2.42
33	Tophouse	11.28	20	3.45	6.62
34	Hanmer Springs	2.45	12	0.84	2.93
35	Highfield, Waiau	2.50	7	0.98	2.51
36	Gore Bay	1.20	5	0.68	2.05
37	Christchurch	1.06	11	0.24	1.87
38	Timaru	1.00	10	0.30	1.96
39	Lambrook Station, Fairlie	1.32	8	0.58	2.01
40	Benmore Station, Clearburn	3.19	14	1.68	2.01
41	Oamaru	1.61	14	0.36	1.93
42	Queenstown	3.56	17	0.55	2.74
43	Clyde	2.96	13	0.58	1.36
44	Dunedin	3.74	17	0.62	3.27
45	Wendon	3.00	15	0.64	2.74
46	Gore	3.23	19	0.65	3.23
47	Invercargill	4.42	22	0.85	4.40
48	Puysegur Point	9.36	23	1.75	8.36
49	Half-moon Bay	4.67	21	0.63	6.15

—Edward Kidson, Director of Meteorological Services, Wellington, 6/12/29.

LIVE-STOCK IN NEW ZEALAND, 1929.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1928-29.	Number of Lambs tailed, 1928-29.	Sheep (including Lambs) as at 30th April, 1929.	Pigs.		Goats.	
				In Milk.	Dry.						Angora.	Other.
North Auckland	..	31,999	53	487,196	208,218	16,976	936,739	436,714	1,040,422	88,156	621	2,927
Auckland	..	44,853	16	788,564	377,007	14,695	1,227,286	730,384	1,291,655	172,766	2,761	4,492
Gisborne	..	18,557	57	316,720	33,009	3,940	2,979,162	1,209,330	3,146,388	19,262	623	2,456
Hawke's Bay	..	15,216	1	217,833	46,916	4,702	2,885,404	1,513,886	3,259,059	18,464	2,360	4,722
Taranaki	..	19,274	1	373,152	190,439	8,207	853,025	428,452	920,791	56,966	21	4,884
Wellington	..	39,337	35	655,609	185,080	12,911	5,310,566	2,877,518	6,023,381	77,720	802	1,105
Nelson	..	6,534	3	63,261	25,906	2,136	369,048	161,986	446,066	16,498	715	1,246
Marlborough	..	6,908	15	43,854	14,750	1,386	1,021,752	459,718	1,124,053	7,712	489	3,488
Westland	..	2,235	..	41,189	11,591	1,343	64,213	48,217	76,987	6,204	2	262
Canterbury	..	57,115	44	168,724	70,746	4,605	4,519,775	2,945,478	5,544,167	53,487	191	14
Otago	..	32,269	5	128,664	49,466	4,621	3,233,528	1,734,898	3,902,845	23,541	4	23
Southland	..	24,689	7	161,024	67,876	5,237	1,895,062	1,219,377	2,275,568	15,956	1	17
Dominion totals	..	298,986	237	3,445,790	1,291,204	79,859	25,205,560	13,855,958	29,051,382	556,732	8,590	25,636
Totals 1928 (or 1927-28)	..	307,160	250	3,273,769	1,242,729	109,669	23,958,577	13,178,972	27,133,810	586,898	5,896	18,355

—Census and Statistics Office.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
NORTH ISLAND.				
1929 ..	8,820,536	87.56	7,723,523	..
1928 ..	8,211,878	84.61	6,948,380	7,280,284
1927 ..	7,905,432	87.28	6,899,861	7,114,057
1926 ..	7,503,200	84.35	6,329,338	6,459,775
1925 ..	7,463,735	85.64	6,391,812	6,345,218
1924 ..	7,148,919	85.00	6,049,654	6,199,881
SOUTH ISLAND.				
1929 ..	7,887,619	89.87	6,998,691	..
1928 ..	7,322,173	87.74	6,424,887	6,569,674
1927 ..	6,926,298	86.17	5,968,979	6,064,915
1926 ..	6,445,052	84.79	5,465,361	5,609,906
1925 ..	6,251,188	78.61	4,914,046	5,090,562
1924 ..	5,927,145	87.87	5,208,378	5,267,266
DOMINION.				
1929 ..	16,608,155	88.65	14,722,214	..
1928 ..	15,534,051	86.09	13,373,267	13,855,958
1927 ..	14,831,730	86.76	12,868,840	13,178,972
1926 ..	13,948,252	84.57	11,794,090	12,069,681
1925 ..	13,715,223	82.43	11,305,858	11,435,780
1924 ..	13,076,094	86.14	11,258,032	11,467,147

The following table gives estimates of the current (1929) season's lambing for the several sheep districts:—

Sheep District	Number of Breeding-ewes.	Estimated Average Percentage of Lambing	Estimated Number of Lambs.
Auckland	1,545,849	88.72	1,371,436
Napier-Gisborne	3,815,256	85.42	3,259,127
Wellington - West Coast ..	3,459,431	89.41	3,092,960
Marlborough-Nelson-Westland ..	777,313	77.2	600,075
Canterbury-Kaikoura	3,524,607	92.1	3,246,148
Otago (including Southland)	3,485,699	90.4	3,152,468
Dominion	16,608,155	88.65	14,722,214

— Live-stock Division.

REGULATION OF TOBACCO EXPORT.

UNDER an amending measure passed in this year's session of Parliament tobacco is added to the list of products subject to the provisions of the Products Export Act, 1908. The Act provides in effect for compulsory grading and/or certifying and marking, prior to export, of the products covered by it.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LICK FOR SHEEP AND CATTLE.

R. C. HAMILTON, Mangaweka :—

Would you please tell me if the following recipe should be successful as a lick for sheep and cattle. 80 lb. common salt, 40 lb. calcium phosphate, 20 lb. bicarbonate of potash, 6 lb. sulphate of iron, 4 oz. potassium iodide, 5 lb. gelatine; dissolve gelatine in water with potassium iodide, and then mix in other ingredients; when well mixed pour into moulds to set.

The Live-stock Division :—

The lick specified by you contains too high a proportion of iron and potash. The following should meet the requirements for both cattle and sheep: Sterilized bone-flour, 40 lb.; finely ground limestone, 40 lb.; common salt, 20 lb.; sulphate of iron, 2 lb.; potassium iodide, 4 oz. This mixture may be fed in boxes or troughs where the animals have free access. It is not considered necessary to prepare the lick in gelatine moulds, although there is no objection to the use of gelatine as a base.

UTILIZATION OF FOWL-MANURE.

J. WORDSWORTH, Geraldine :—

I have a lot of fowl-manure stored in a shed and not exposed to weather conditions. I heard from an orchardist that he buys fowl-manure and mixes it with superphosphate. Is this advisable, and what proportion of super should one mix?

The Horticulture Division :—

Fowl-manure, which is rich in nitrogen, is best stored under cover and spread in alternate layers with fine soil at a rate of two parts of the former to one of the latter. Before use it should be turned and mixed to bring it to an even friable state. An application of 10 cwt. per acre is an ordinary dressing. The nitrogen is readily available for an organic manure, and it is used largely for top-dressing green crops or stimulating crops on which a heavy setting of flowers or fruit has been made. As a balanced fertilizer for more general purposes the phosphoric acid and potash content may be increased by adding 24 lb. superphosphate and 12 lb. potash salts per hundredweight. These may be either mixed in or applied to the land separately. For 4 acres of fruit or vegetables one hundred birds would supply about all the fertilizers required, together with a little cover-cropping.

PRECAUTIONS AGAINST SHEEP BLOWFLY.

J. B. VOWLES, Te Mata :—

Will you please inform me what to use when sheep are struck with the fly. I have used several things, such as liquid dip, kerosene, &c. These I find are deadly on the maggot, but they will not prevent the fly striking again.

The Live-stock Division :—

The most satisfactory method to prevent the fly striking is to dip with an arsenical dip; liquid dips are of little value. There is no danger in using an arsenical dip if the directions for dipping are thoroughly carried out. If sheep

are dipped off the shears the lasting preventive effect on the fly is less than on those dipped in the wool, and therefore the former should be redipped in two or three months' time. In dipping lambs great care must be taken and the dip made weaker. If the fly strikes sheep which have been thoroughly dipped the maggots will die and cause little or no trouble. A very necessary precaution against blow-fly attack is to ensure that the sheep are clean and properly crutched; also, if possible, the sheep should be kept in open paddocks and away from trees and sheltered positions, as it is in such places that the fly is most prevalent.

FRUITING OF FIG-TREES.

J. B. VOWLES, Te Mata :—

I have read an article stating that the fig-tree will not bear fruit unless the wild fig is grown in the same plantation. Will you please inform me where I can secure the wild fig, which by the article is called Capri fig.

The Horticulture Division :—

The statement to the effect that the fig-tree will not bear fruit unless the wild fig is grown in the same plantation is a generalization that is obviously incorrect, as in many parts of the country very good fresh figs are grown and ripened with no Capri figs in the vicinity. The fact is that the Smyrna fig and allied varieties will not crop satisfactorily without two or three varieties of Capri figs and colonies of fig-wasps (*Blastofaga grossorum*) occupying them. A number of Capri fig varieties are required so that figs of a suitable size for the wasp when egg-laying may be available throughout the year. Some of the leading commercial varieties of fresh and dried figs—White Adriatic, for instance—do not require this attention. One or two attempts to introduce the wasp into this country have been made without success, probably due to the fact that a suitable series of Capri fig varieties was not available to maintain the stock. This interesting problem is still receiving attention, but its commercial possibilities are not very promising, as a dry, hot climate is required to produce Smyrna dried figs of good quality

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations :—

Helensville A. and P. Association : Helensville, 29th January.
 Opotiki A. and P. Association : Opotiki, 1st February.
 Feilding A. and P. Association : Feilding, 4th and 5th February.
 Whakatane A. and P. Association : Whakatane, 5th February.
 King Country A. and P. Association : Te Kuiti, 6th February.
 Rodney Agricultural Society : Warkworth, 8th February.
 Te Puke A. and P. Association : Te Puke, 8th February.
 Dannevirke A. and P. Association : Dannevirke, 11th and 12th February.
 Tauranga A. and P. Association, Tauranga, 11th and 12th February.
 Franklin A. and P. Association : Pukekohe, 14th and 15th February.
 Masterton A. and P. Association : Solway, 18th and 19th February.
 Katikati A. and P. Society : Katikati, 19th February.
 Marton A. and P. Association : Marton, 26th February.
 Auckland A. and P. Association : Auckland, 27th February to 1st March.
 Taranaki Agricultural Society : New Plymouth, 5th and 6th March.
 Waikato Central Agricultural Association : Cambridge, 5th and 6th March.
 Morrinsville A. and P. Society : Morrinsville, 12th March.
 Hawke's Bay A. and P. Society : Autumn Show, Tomoana, 19th March.
 Methven A. and P. Association : Methven, 29th March.
 Oxford A. and P. Association : Oxford, 3rd April.

FRUIT EXPORT GUARANTEE AND REGULATIONS, 1930.

THE conditions of the Government guarantee for the 1930 season are substantially the same as those for 1929 (published in the *Journal* for November, 1928), only formal or minor amendments having been made.

Amendments to the export regulations consist mainly of additions to the lists of varieties approved for export as follows: Apples—Glengyle Red, Crofton, McLiver's Winesap, Tasma Pride, Grooby's Seedling, Pride of Australia, Desert Gold. Pears—Broom Park, Harrington's Victoria, Giblin's Nelis, Twyford Monarch. General provisions are practically unaltered.

The full conditions and regulations as amended have been printed in pamphlet form

CROP AREAS AND YIELDS, SEASONS 1927-28 AND 1928-29.

Crop.	1927-28.		1928-29.	
	Area.	Average Yield per Acre.	Area.	Average Yield per Acre.
Wheat -	Acre.s.		Acre.s.	
Grain	260,987	36.56 bushels	255,312	34.60 bushels.
Chaff, &c	1,191	2.00 tons	1,272	1.79 tons.
Oats—				
Grain	88,223	43.66 bushels	73,101	41.93 bushels.
Chaff, &c	201,437	1.71 tons	194,638	1.71 tons.
Barley—				
Grain	21,091	40.87 bushels	19,500	40.06 bushels.
Chaff, &c	661	1.83 tons	340	2.27 tons.
Maize --				
Grain	10,201	46.93 bushels	8,986	50.78 bushels.
Ensilage	549	3.23 tons	295	3.59 tons.
Peas	25,128	31.93 bushels	17,893	29.48 bushels.
Beans			170	25.20 bushels.
Linseed	5,213	6.00 cwt	2,800	8.30 cwt
Rye-grass seed ..	23,545	444.60 lb.	26,343	428.59 lb.
Cocksfoot seed ..	11,493	173.36 lb.	11,255	182.04 lb.
Chewings fescue seed ..	10,021	267.90 lb.	9,506	286.46 lb.
Crested dogtail seed ..	8,948	236.19 lb.	5,702	223.92 lb.
Red clover and cow-grass seed ..	7,887	180.00 lb.	9,750	197.60 lb.
White clover seed ..	2,294	165.55 lb.	3,338	169.68 lb.
Other grass and clover seeds ..	1,493	120.04 lb.	2,123	114.93 lb.
Grass and clover hay ..	250,984	1.76 tons	320,299	1.92 tons.
Lucerne hay	29,257	2.44 tons	30,808	2.62 tons.
Potatoes	21,693	5.59 tons	21,304	5.77 tons.
Green fodder crops ..	216,702	..	219,088	..
Turnips	459,704	..	479,994	..
Mangolds	10,329	..	9,914	..
Onions	703	8.70 tons	880	12.07 tons.
Hops	609	1,246.68 lb.	608	1,274.24 lb.
Tobacco*	690	..	1,000	..

* Outside borough boundaries.

Unidentified Subscription Remittance for Journal.—Postal notes to the value of 6s. 6d. (No. 472499, 1s. 6d., and No. 033588, 5s.), issued at Palmerston North on 8/11/29, and posted at Foxton on 18/11/29, have been received without any advice as to the remitter. Any communications in this matter should be addressed to the Publisher, Department of Agriculture, Wellington.



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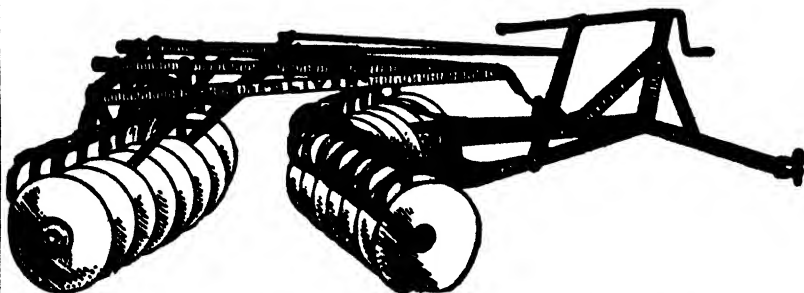
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Portion of Ruakura Farm of Instruction, showing College buildings to right and left of view, and Manager's residence in foreground.

THE Ruakura Farm of Instruction is situated in Waikato County, and adjoins the Borough of Hamilton. The farm was established as an experimental station in 1901. The training of farm students was commenced in 1912, from which time twelve students were continuously in residence. In 1920 buildings were erected to accommodate sixty returned soldiers. On the completion of the repatriation work the teaching of farm students was reorganized, and a system of resident instruction was established in August, 1923, the educational institution being termed the Ruakura Farm Training College.

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A prospectus giving all details may be obtained from the Director-General, Department of Agriculture, Wellington; the Director of the Fields Division, Department of Agriculture, Box 240, Palmerston North; or the Manager, Ruakura Farm of Instruction, Hamilton.

FEES.

The fee for each term for tuition and board (including soft washing) is £18. All fees are payable in advance. Students leaving before the end of their course are required to give three months' notice.

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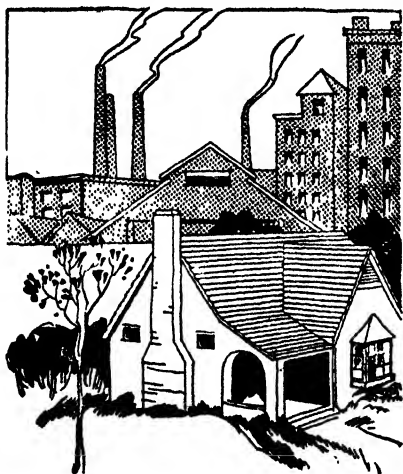
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made at

TE KAUWHATA HORTICULTURAL STATION.

Only Address.

"The Manager, Te Kauwhata Horticultural Station, Te Kauwhata."

Wine in Case.

(A case contains 12 reputed quarts—2 gallons.)

FRONTIGNAC (sweet red)	..	..	30s. per case.
MADEIRA (sweet white)	..	..	30s. per case.
CLARET (dry red)	..	..	25s. per case.

(Any assortment of the above can be packed to a case if required.)

Wine in Bulk.

FRONTIGNAC and MADEIRA can be supplied in bulk if required, provided suitable containers are supplied by the purchasers, but not otherwise. (Bottles not accepted; kegs or jars only.) Freight on containers forwarded for filling must be prepaid. Bulk rates are as follows:—

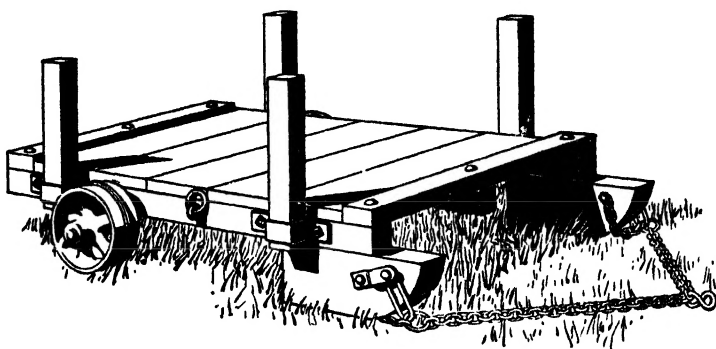
2 gallons	..	..	10s. per gallon (£1).
5 ..	..	..	9s. 6d. per gallon (£2 7s. 6d.).

(Rates for larger quantities supplied on application.)

TERMS AND CONDITIONS OF SALE.

MINIMUM QUANTITY SOLD: 2 gallons. Wine is delivered free on rail at Te Kauwhata, the freight being payable by purchasers. Cheques payable to "Department of Agriculture" and crossed "Public Account." Orders cannot be accepted unless accompanied by a remittance covering the price of the wine, and the exchange when drawn on banks outside Auckland City. All freight to flag stations and ports beyond the railway must be prepaid. Under the Licensing Amendment Act, 1914, wine cannot be sent into a no-license area excepting on an "order signed by and stating the address and occupation of the purchaser thereof."

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